PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-167902
(43)Date of publication of application : 22.06.2001

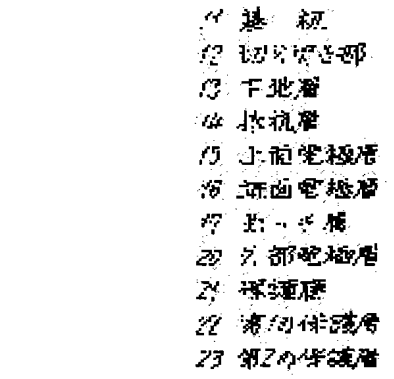
(51)Int.Cl. H01C 7/00
H01C 17/06

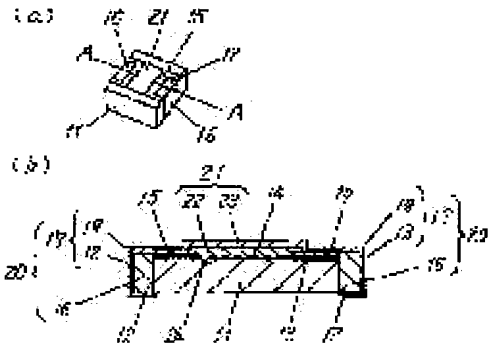
(21)Application number : 11-351284
(22)Date of filing : 10.12.1999

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : HASHIMOTO MASATO
FUKUOKA AKIO

(54) RESISTOR AND MANUFACTURING METHOD THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a resistor capable of restraining cutting cost of a substrate, and its manufacturing method.
SOLUTION: This resistor consists of a substrate 11, a resistance layer 14 formed on an upper surface of the substrate 11, and a pair of upper surface electrode layers 15 arranged in both end portions of an upper surface of the resistance layer 14. The substrate 11 is composed of a resin based material.





LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] It is the resistor which has a substrate, the resistive layer prepared in the top face of said substrate, and the top-face electrode layer of the pair prepared in the both ends of the top face of said resistive layer, and is characterized by said substrate consisting of an ingredient of a resin system.

[Claim 2] The resistor according to claim 1 characterized by forming a resistive layer in the top face of the substrate layer which consists of an oxide in which it was prepared on the top face of a substrate.
[Claim 3] The resistor according to claim 1 characterized by a substrate consisting of a liquid crystal polymer.
[Claim 4] The resistor according to claim 1 characterized by forming the external electrode layer which consists of a plating layer formed in the front face of the end-face electrode layer of the pair prepared in the end face of said substrate so that it might connect with the top-face electrode layer of a pair electrically, and said end-face electrode layer in the notching section of the pair in which it was prepared to the both ends of said substrate.
[Claim 5] The resistor according to claim 4 characterized by constituting an end-face electrode layer from an ingredient which consists of metal powder and resin.
[Claim 6] The resistor according to claim 4 characterized by preparing the top face of an external electrode layer above the top face of a protective coat.
[Claim 7] The resistor according to claim 4 characterized by making it not prepare an external electrode layer in the rear face of a substrate.
[Claim 8] The resistor according to claim 4 characterized by preparing an external electrode layer in the top face of a top-face electrode layer.
[Claim 9] The resistor according to claim 1 characterized by consisting of the 1st protective layer which the protective coat prepared so that a

resistive layer might be covered at least becomes from an oxide, and the 2nd protective layer which consists of resin formed in the top face of said 1st protective layer.

[Claim 10] A substrate, two or more resistive layers prepared in the top face of said substrate, and two or more pairs of top-face electrode layers prepared in the both ends of each top face of two or more of said resistive layers, Two or more external electrode layers which consist of a plating layer formed in the front face of said two or more pairs of end-face electrode layers prepared in the end face of said substrate so that more than one might connect with a pair of top-face electrode layer electrically, and said end-face electrode layer, Said substrate is a resistor characterized by forming a crevice in the part which consists of an ingredient of a resin system and is located between said external electrode layers in the end face of said substrate.

[Claim 11] The process which prepares the substrate layer which becomes the substrate which consists of an ingredient of a resin system from an oxide, So that it may connect with the process which prepares a resistive layer in the top face of said substrate layer, the process which prepares the top-face electrode layer of a pair in the both ends of the top face of said resistive layer, and the top-face electrode layer of said pair electrically The manufacture approach of the resistor characterized by having the process which prepares the end-face electrode layer of the pair formed in the end face of said substrate, the process which prepares a plating layer in the front face of the end-face electrode layer of said pair, and forms an external electrode layer, and the process which prepares a protective coat so that said resistive layer may be covered at least.

[Claim 12] The manufacture approach of the resistor according to claim 11 characterized by making it form by stiffening the mixed paste which consists an end-face electrode layer of metal powder and resin.

[Claim 13] The manufacture approach of the resistor according to claim 11 characterized by carrying out pattern NINGU with a FOTORISO method of construction at a predetermined configuration, respectively after forming a top-face electrode layer and a resistive layer by the spatter.

[Claim 14] A substrate layer and a protective coat are the manufacture approach of the resistor according to claim 11 characterized by what was formed of the spatter.

[Claim 15] The process which prepares a substrate layer in the substrate which consists of an ingredient of a resin system, and the process which prepares two or more resistive layers in the top face of said substrate layer, So that it may connect with the process which prepares two or more pairs of top-face electrode layers in the both ends of the top face of two or more of said resistive layers, and said two or more pairs of top-face electrode layers

electrically The process which prepares a plating layer in the front face of two or more pairs of end-face electrode layers formed in the end face of said substrate, and said end-face electrode layer, and forms an external electrode layer, The manufacture approach of the resistor characterized by forming a crevice in the part which is equipped with the process which prepares a protective coat so that said two or more resistive layers may be covered at least, and is located between said external electrode layers in the end face of said substrate.

[Claim 16] The manufacture approach of the resistor according to claim 11 or 15 characterized by establishing the fluting and transverse groove for division in a substrate so that the field equivalent to one resistor may be divided continuously, after preparing a protective coat at least, dividing said substrate along the fluting and transverse groove for said division, and obtaining two or more resistors.

[Claim 17] The manufacture approach of the resistor according to claim 16 characterized by forming the fluting and transverse groove for division with laser.

[Claim 18] The manufacture approach of the resistor according to claim 16 characterized by having prepared the through tube so that the part used as the fluting of a substrate might be straddled and a transverse groove might not be straddled, connecting said conductor to a top-face electrode layer electrically, and preparing an end-face electrode layer while making said through tube fill up with a conductor.

[Claim 19] The manufacture approach of the resistor according to claim 16 characterized by having prepared the through tube so that the part used as the fluting of a substrate might be straddled and a transverse groove might not be straddled, and forming an end-face electrode layer in said through tube by the spatter.

[Claim 20] The manufacture approach of the resistor according to claim 16 characterized by forming an end-face electrode layer in the fluting or transverse groove for division by the spatter.

[Claim 21] The manufacture approach of the resistor according to claim 16 characterized by dividing a substrate as the fluting and transverse groove for division are established in a substrate and said sheet bridging is made to separate from a substrate after that after sticking a sheet bridging on a substrate.

[Claim 22] The manufacture approach of the resistor according to claim 21 characterized by using the thing containing the adhesives which have an ultraviolet curing property as a sheet bridging.

[Claim 23] The process into which a sheet bridging is made to separate from a substrate is the manufacture approach of the resistor according to claim 22 characterized by carrying out by irradiating ultraviolet rays.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the resistor used for various electronic equipment or the multiple-string chip resistor by which pattern formation was carried out minutely, and its manufacture approach.
[0002]
[Description of the Prior Art] In order to raise the packaging density to a printed circuit board with the miniaturization of electronic equipment in recent years, the demand of multiple-string-izing from which a miniaturization and two or more independent components are one unit has been increasing to electronic parts, such as a resistor used for electronic equipment.
[0003] What was indicated by the microfilter of JP,4-38001,U is known as a conventional resistor.
[0004] In addition, the multiple-string chip resistor with which the resistive layer which the plurality which is one of resistors became independent of is one unit is described as a resistor here.
[0005] Hereafter, a conventional resistor and its conventional manufacture approach are explained, referring to a drawing.
[0006] Drawing 18 (a) is the perspective view of the conventional resistor, and drawing 18 (b) is this E-E line sectional view.
[0007] In drawing 18 , 1 is an insulating substrate which consists of an alumina. 2 is two pairs of top-face electrode layers prepared in the both ends of the top face of an insulating substrate 1. 3 is two resistive layers prepared so that a part might lap with two pairs of top-face electrode layers 2. At this time, two resistive layers 3 have been independent. 4 is the protective layer prepared so that the two whole resistive layer 3 might be covered. 5a is two pairs of side-face electrode layers prepared in the side face of an insulating substrate 1. 5b is a plating layer which consists of nickel

prepared in the front face of two pairs of top-face electrode layers 2, and 2 pairs of side-faces electrode layer 5a, and solder plating.
[0008] About the conventional resistor constituted as mentioned above, the manufacture approach is explained below, referring to a drawing.
[0009] Drawing 19 and drawing 20 are process drawings showing the manufacture approach of the conventional resistor.
[0010] First, insulating-substrate 8a of the shape of a sheet in the case of manufacturing the conventional resistor to drawing 19 (a) is shown. Division slot 10b of the division slot 10a and the longitudinal direction of a through hole 9 and a lengthwise direction is formed in this insulating-substrate 8a.
[0011] Next, as shown in drawing 19 (b), printing formation of two or more resistive layers 3 is carried out so that printing formation of two or more pairs of top-face electrode layers 2 may be carried out and it may lap with the top face of sheet-like insulating-substrate 8a further at a part of each of a pair of top-face electrode layer 2.
[0012] Next, after carrying out printing formation of two or more protective layers 4 so that two or more whole resistive layers 3 may be covered as shown in drawing 20 (a), it divides along with lateral division slot 10b (it illustrates to drawing 18), and divides into strip-of-paper-like insulating-substrate 8b.
[0013] Next, as shown in drawing 20 (b), application formation of the side-face electrode layer 5a is carried out at the lateral portion of strip-of-paper-like insulating-substrate 8b.
[0014] Then, strip-of-paper-like insulating-substrate 8b is divided along with division slot 10a of a lengthwise direction, and a piece of individual-like insulating substrate (not shown) is obtained.
[0015] Finally, as shown in drawing 18 (a), after performing nickel plating to the front face of the top-face electrode layer 2 and side-face electrode layer 5a, by performing solder plating, plating layer 5b was formed and the conventional resistor was manufactured.
[0016] Moreover, the resistor of the very small multiple-string form which built two elements in the die-length [of 0.6mm] x width-of-face [of 0.8mm] x thickness of 0.35mm in recent years has also come to be manufactured by miniaturizing said resistor very much.
[0017]
[Problem(s) to be Solved by the Invention] Since what calcinated porcelain, such as an alumina, as a substrate 1 was used for the above-mentioned conventional resistor, dimension variation had produced it in the substrate by the presentation variation of a substrate, or the temperature variation at the time of baking (this dimension variation amounts to about 0.5mm in the substrate of 100mm of about 100mmx abbreviation).
[0018] When a resistor was manufactured using a substrate with this

dimension variation, many masks used for screen-stencil were prepared, it will be necessary to exchange masks according to the dimension variation of a substrate, and the process was complicated very much.

[0019] Namely, since a formation location will shift and it will become a defect, if the mask used for the screen-stencil for forming the top-face electrode layer 2, a resistive layer 3, a protective layer 4, etc. to a substrate with dimension variation shifts, it is because the mask used for screen-stencil of the top-face electrode layer 2 which classifies a substrate with dimension variation into a fine dimension rank, and is equivalent to each dimension rank, a resistive layer 3, a protective layer 4, etc. is needed (a dimension rank -- a lengthwise direction --) When classifying according to 0.05mm unit of each longitudinal direction, about 600 or more ranks needed to be dimension classified. Moreover, since especially a multiple-string chip resistor has the resistive layer which plurality became independent of in one unit, a top-face electrode layer, a resistive layer, and a protective layer serve as a very detailed pattern configuration, and this poses a very big problem.

[0020] Furthermore, although the need of classifying a substrate into a dimension rank will be lost if a substrate is cut after screen-stencil of a top-face electrode layer, a resistive layer, a protective layer, etc. in order to cancel the complicatedness of the above-mentioned process If it carries out using the cutting edge containing a diamond so that the silicon wafer of a semi-conductor may be cut for this cutting, since the alumina is harder than the silicon wafer of a semi-conductor, Wear of the cutting edge for dividing had very much the technical problem that cutting cost became great, in early, consequently this approach.

[0021] This invention solves the above-mentioned conventional technical problem, and aims at offering the resistor which can hold down the cutting cost of a substrate, and its manufacture approach.

[0022]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the resistor of this invention has a substrate, the resistive layer prepared in the top face of said substrate, and the top-face electrode layer of the pair prepared in the both ends of the top face of said resistive layer, it is characterized by said substrate consisting of an ingredient of a resin system, and according to this configuration, the effectiveness that the cutting cost of a substrate can be held down is acquired.

[0023]

[Embodiment of the Invention] It is what is characterized by for invention of this invention according to claim 1 having a substrate, the resistive layer prepared in the top face of said substrate, and the top-face electrode layer of the pair prepared in the both ends of the top face of said resistive layer,

and said substrate consisting of an ingredient of a resin system. Since the substrate which consists of an ingredient of a resin system softer than an alumina was used according to this configuration, wear of the cutting edge for substrate cutting can be suppressed, and this has an operation that the cutting cost of a substrate can be held down.

[0024] It is what is characterized by invention according to claim 2 forming a resistive layer in the top face of the substrate layer which consists of an oxide in which it was prepared on the top face of a substrate. Since the substrate layer which consists of an oxide was formed in the substrate top face which consists of an ingredient of the resin system which is generally hygroscopic according to this configuration, invasion to the substrate of moisture can be decreased by the substrate layer which consists of an oxide, and this has an operation that the moisture resistance of a substrate improves.

[0025] Since invention according to claim 3 is characterized by a substrate consisting of a liquid crystal polymer, and the coefficient of thermal expansion of a substrate can choose it easily according to this configuration, it can adjust relation with the coefficient of thermal expansion of a resistive layer or a printed circuit board, and, thereby, has an operation that the curvature of the substrate at the time of use by the difference in a coefficient of thermal expansion etc. can be prevented.

[0026] Invention according to claim 4 the external electrode layer which consists of a plating layer formed in the front face of the end-face electrode layer of the pair prepared in the end face of said substrate so that it might connect with the top-face electrode layer of a pair electrically, and said end-face electrode layer It is what is characterized by forming in the notching section of the pair prepared in the both ends of a substrate. According to this configuration, it has an operation that the resistor by which only the part in which an end-face electrode layer does not project from a substrate included the end-face electrode layer is made into a miniaturization, rather than what prepared the end-face electrode layer in the substrate without the notching section.

[0027] Since invention according to claim 5 is characterized by constituting an end-face electrode layer from an ingredient which consists of metal powder and resin, and it can calcinate an end-face electrode layer at the low temperature of 130 degrees C - 240 degrees C according to this configuration, it can suppress the effect of the heat to a resistive layer, and, thereby, has an operation that the resistance value change under production can be made small.

[0028] Invention according to claim 6 is characterized by preparing the top face of an external electrode layer more nearly up than the top face of a protective coat, and even if it turns the top-face side of a substrate to a

printed circuit board side, in order that the top face of an external electrode may contact a printed circuit board according to this configuration, whichever it turns [of the vertical side of a substrate] to a printed circuit board side, it has an operation that mounting becomes possible.

[0029] Invention according to claim 7 is characterized by making it not prepare an external electrode layer in the rear face of a substrate, and according to this configuration, since the stability at the time of adsorption improves when the rear face of a substrate is adsorbed by the adsorption pin of an automatic mounting machine, the top-face side of a substrate is turned to a printed circuit board side and it mounts in a printed circuit board, it has an operation that the high rate of mounting is securable.

[0030] It is what is characterized by invention according to claim 8 preparing an external electrode layer in the top face of a top-face electrode layer. Since the touch area of an external electrode layer and a top-face electrode layer becomes large according to this configuration, Even if it receives environmental loads, such as a thermal shock, the increment in contact resistance in the meantime can be suppressed, and thereby, since a resistive layer can make small the rate of the increment of the contact resistance to the resistance of a resistive layer also in low ******, it has an operation that the rate of a change in resistance can be made low.

[0031] It is what is characterized by invention according to claim 9 consisting of the 1st protective layer which the protective coat prepared so that a resistive layer might be covered at least becomes from an oxide, and the 2nd protective layer which consists of resin formed in the top face of said 1st protective layer. Since a resistive layer is covered by the 1st protective layer which consists of a heat-resistant outstanding oxide, and the 2nd protective layer which consists of resin excellent in moisture resistance according to this configuration, a resistive layer is not influenced of heat or moisture, but, thereby, has an operation that the rate of a change in resistance at the time of use can be made small.

[0032] Two or more resistive layers by which invention according to claim 10 was prepared in the top face of a substrate and said substrate, Two or more pairs of top-face electrode layers prepared in the both ends of each top face of two or more of said resistive layers, Two or more external electrode layers which consist of a plating layer formed in the front face of said two or more pairs of end-face electrode layers prepared in the end face of said substrate so that more than one might connect with a pair of top-face electrode layer electrically, and said end-face electrode layer, It is what is characterized by forming a crevice in the part which it has the protective coat prepared so that said two or more resistive layers might be covered at least, and said substrate consists of an ingredient of a resin system, and is located between said external electrode layers in the end face of said substrate. Since the

substrate which consists of an ingredient of a resin system softer than an alumina was used according to this configuration, In the multiple-string chip resistor which has the resistive layer which plurality became independent of in addition to the ability to suppress wear of the cutting edge for substrate cutting, and hold down the cutting cost of a substrate by this Since the distance in the end face of a substrate is separated between each external electrode layer corresponding to each resistive layer with the crevice, it has an operation that it can prevent that external electrode layers contact and resistive layers connect electrically at the time of formation of an external electrode layer.

[0033] The process which prepares the substrate layer which becomes the substrate with which invention according to claim 11 consists of an ingredient of a resin system from an oxide, So that it may connect with the process which prepares a resistive layer in the top face of said substrate layer, the process which prepares the top-face electrode layer of a pair in the both ends of the top face of said resistive layer, and the top-face electrode layer of said pair electrically The process which prepares the end-face electrode layer of the pair formed in the end face of said substrate, and the process which prepares a plating layer in the front face of the end-face electrode layer of said pair, and forms an external electrode layer, It is what is characterized by having the process which prepares a protective coat so that said resistive layer may be covered at least. Since the substrate which consists of an ingredient of a resin system softer than an alumina was used according to this manufacture approach, wear of the cutting edge for substrate cutting at the time of substrate cutting can be suppressed, and this has an operation that the cutting cost of a substrate can be held down.

[0034] It is what is characterized by forming invention according to claim 12 by stiffening the mixed paste which consists an end-face electrode layer of metal powder and resin. According to this manufacture approach, since it can calcinate at the low temperature of 130 degrees C - 240 degrees C of end-face electrode layers, the effect of the heat to a resistive layer can be suppressed, and this has an operation that the resistance value change under production can be made small.

[0035] It is what is characterized by carrying out pattern NINGU of it with a FOTORISO method of construction at a predetermined configuration, respectively after invention according to claim 13 forms a top-face electrode layer and a resistive layer by the spatter. Since a top-face electrode layer and a resistive layer can be formed thinly according to this manufacture approach, Since pattern formation of the resistive layer is carried out with high precision by the FOTORISO process in addition to becoming easy to divide a substrate in the fluting or transverse groove for division, Effective area of a resistive layer can be enlarged, and thereby, even if high power is

impressed, it has an operation that the rate of a change in resistance can be made low.

[0036] Since invention according to claim 14 is characterized by what the substrate layer and the protective coat were formed for of the spatter, and it can form a substrate layer and a protective coat precisely according to this manufacture approach, moisture stops being able to enter easily to a resistive layer, and, thereby, it has an operation that a resistive layer is stabilized.

[0037] The process which prepares a substrate layer in the substrate with which invention according to claim 15 consists of an ingredient of a resin system, So that it may connect with the process which prepares two or more resistive layers in the top face of said substrate layer, the process which prepares two or more pairs of top-face electrode layers in the both ends of the top face of two or more of said resistive layers, and said two or more pairs of top-face electrode layers electrically The process which prepares a plating layer in the front face of two or more pairs of end-face electrode layers formed in the end face of said substrate, and said end-face electrode layer, and forms an external electrode layer, It is what is characterized by forming a crevice in the part which is equipped with the process which prepares a protective coat so that said two or more resistive layers may be covered at least, and is located between said external electrode layers in the end face of said substrate. In order to use the substrate which consists of an ingredient of a resin system softer than an alumina according to this manufacture approach, In the multiple-string chip resistor which has the resistive layer which plurality became independent of in addition to the ability to suppress wear of the cutting edge for substrate cutting, and hold down the cutting cost of a substrate by this In order that the distance in the end face of a substrate may separate by the crevice between each external electrode layer corresponding to each resistive layer, it has an operation that it can prevent that external electrode layers contact and resistive layers connect electrically at the time of formation of an external electrode layer.

[0038] Invention according to claim 16 establishes the fluting and transverse groove for division in a substrate so that the field equivalent to one resistor may be divided continuously, after preparing a protective coat at least. It is what is characterized by dividing said substrate along the fluting and transverse groove for said division, and obtaining two or more resistors. In order to divide a substrate after formation of a top-face electrode layer, a resistive layer, an end-face electrode layer, a protective coat, etc. according to this manufacture approach, The need of classifying a substrate into a dimension rank is lost, and in order to form an end-face electrode layer etc., it becomes unnecessary to divide a substrate in the shape of a strip of paper

once by this in addition to the complicatedness of a process being solved. By this Two or more resistors can be obtained only by carrying out a batch rate, consequently it has an operation that a process can be simplified.

[0039] Invention according to claim 17 is characterized by forming the fluting and transverse groove for division with laser, and according to this manufacture approach, since it can form the fluting and transverse groove certainly [the part by which laser was irradiated] for division to a high speed, it has an operation that productivity improves.

[0040] A through tube is prepared so that invention according to claim 18 may straddle the part used as the fluting of a substrate and a transverse groove may not be straddled. It is what is characterized by connecting said conductor to a top-face electrode layer electrically, and preparing an end-face electrode layer while making said through tube fill up with a conductor. Since an end-face electrode layer can be formed in the field equivalent to one resistor surrounded by the fluting and the transverse groove according to this manufacture approach, Rather than what prepared the end-face electrode layer after dividing a substrate in the shape of a piece of an individual, it has an operation that the resistor by which only the part in which an end-face electrode layer does not project from a substrate included the end-face electrode layer can be miniaturized.

[0041] It is what is characterized by for invention according to claim 19 having prepared the through tube so that the part used as the fluting of a substrate might be straddled and a transverse groove might not be straddled, and forming an end-face electrode layer in said through tube by the spatter. Since an end-face electrode layer can be formed in the field equivalent to one resistor surrounded by the fluting and the transverse groove according to this manufacture approach, Since only the part in which an end-face electrode layer does not project from a substrate can form an end-face electrode very thinly rather than what prepared the end-face electrode layer in addition to a resistor including an end-face electrode layer being made into a miniaturization after dividing a substrate in the shape of a piece of an individual, An end-face electrode layer enters certainly in a through tube, and it has an operation that it is stabilized and an end-face electrode layer can be prepared by this.

[0042] Invention according to claim 20 has an operation that an end-face electrode layer enters into division Mizouchi certainly, it is stabilized in it by this, and an end-face electrode layer can be prepared in it since it is characterized by forming an end-face electrode layer by the spatter, and an end-face electrode layer can be formed in the fluting or transverse groove for division very thinly according to this manufacture approach.

[0043] It is what is characterized by dividing a substrate as it establishes the fluting and transverse groove for division in a substrate and makes said sheet

bridging separate from a substrate after that after invention according to claim 21 sticks a sheet bridging on a substrate. According to this manufacture approach, a location gap is caused when one side is prepared among the fluting for division, and a transverse groove. Cannot establish the slot for another division in a position, or When a substrate is divided, each piece of individual-like resistors are scattered scatteringly, and it has an operation that it can prevent that a next process becomes complicated.
[0044] It is what is characterized by invention according to claim 22 using the thing containing the adhesives which have an ultraviolet curing property as a sheet bridging. Since the adhesive strength of a sheet bridging can be lost by irradiating ultraviolet rays at high speed according to this manufacture approach, Since the adhesive strength of a sheet bridging can be lost fundamentally in addition to productivity improving, it has an operation that a sheet bridging is certainly separable from a substrate.
[0045] It is characterized by performing the process into which invention according to claim 23 makes a sheet bridging separate from a substrate by irradiating ultraviolet rays, and since the adhesive strength of a sheet bridging can be easily lost by irradiating ultraviolet rays according to this manufacture approach, it has an operation that a sheet bridging is easily separable from a substrate.
[0046] (Gestalt 1 of operation) The resistor in a gestalt 1 and its manufacture approach of operation are explained hereafter, referring to a drawing.
[0047] The perspective view of a resistor [in / in drawing 1 (a) / the gestalt 1 of operation of this invention] and drawing 1 (b) are these A-A line sectional views. In addition, drawing 1 (a) is omitting the plating layer 17 mentioned later.
[0048] In drawing 1 (a) and (b), 11 is a substrate, has the notching section 12 to both ends, and consists of an ingredient of resin systems, such as resin, a resin compound, and resin mixture. The configuration of this notching section 12 is seen from the upper part of a substrate 11, and has become abbreviation rectangle-like. Of course, you may be other configurations, such as the shape of an abbreviation hemicycle. 13 is a substrate layer, is prepared in the top face of a substrate 11, and consists of an oxide which uses an alumina as a principal component. 14 is a resistive layer and is prepared in substrate 11 top face through the substrate layer 13. What is necessary is just to select the ingredient of a resistive layer 14 from ruthenium oxide, nickel-Lynn, etc. by target resistance, application, etc.
[0049] In addition, if a liquid crystal polymer is used, since the thing of a suitable coefficient of thermal expansion can be easily chosen as a substrate 11 among the liquid crystal polymers from which a coefficient of thermal expansion differs, relation with the coefficient of thermal expansion of a

resistive layer 14 or a printed circuit board can be adjusted, and, thereby, the effectiveness that the curvature of the substrate 11 at the time of use by the difference in a coefficient of thermal expansion etc. can be prevented is acquired. Moreover, since the oxide which uses the alumina of the substrate layer 13 as a principal component can decrease invasion to the substrate 11 of moisture, it is for acquiring the effectiveness of raising the moisture resistance of the substrate 11 which consists of an ingredient of resin systems, such as a liquid crystal polymer which is generally hygroscopic.

[0050] 15 is the top-face electrode layer of a pair, is prepared in the both ends of the top face of a resistive layer 14, and consists of an ingredient of a golden system. 16 is the end-face electrode layer of a pair, is formed in the notching section 12 prepared in the both ends of a substrate 11, and consists of a conductor so that it may connect with each end face of a resistive layer 14 and the top-face electrode layer 15 electrically. If the ingredient which consists of metal powder and resin as this conductor is used, since an end-face electrode layer can be calcinated at the low temperature of 130 degrees C - 240 degrees C, the effect of the heat to a resistive layer can be suppressed, and, thereby, the resistance value change under production can be made small.

[0051] Thus, by forming the end-face electrode layer 16 in the notching section 12 in which it was prepared to the both ends of a substrate 11, the effectiveness that the resistor by which only the part in which the end-face electrode layer 16 does not project from a substrate 11 included the end-face electrode layer 16 is made into a miniaturization is acquired rather than what prepared the end-face electrode layer in the substrate without the notching section. Moreover, since the end-face electrode layer 16 is formed so that the notching section 12 whole may be buried, consequently it can enlarge the cross section of an external electrode layer, it can raise bonding strength with a printed circuit board.

[0052] 17 is a plating layer, is prepared in a part of front face of the end-face electrode layer 16, and top face of the top-face electrode layer 15, and consists of a nickel-plating layer (barrier layer) 18 and a low-melt point point metal plating layer 19. Moreover, in the front face of the end-face electrode layer 16, the low-melt point point metal plating layer 19 is formed in the front face of the nickel-plating layer 18 and the nickel-plating layer 18. 20 is an external electrode layer, consists of an end-face electrode layer 16 and a plating layer 17, is formed in a part of end face of a substrate 11, and top face of the top-face electrode layer 15, and is not prepared in the rear face of a substrate 11. 21 is a protective coat, it is prepared so that a resistive layer 14 may be covered at least, and it consists of the 1st protective layer 22 which consists of oxides, such as an alumina and a silica, and the 2nd protective layer 23 which consists of a phenol system or an

epoxy resin. Moreover, the 2nd protective layer 23 is formed in the top face of the 1st protective layer 22 and the 1st protective layer 22 on the top face of a resistive layer 14.

[0053] Thus, since the stability at the time of adsorption improves when the rear face of a substrate 11 is adsorbed by the adsorption pin of an automatic mounting machine, the top-face side of a substrate 11 is turned to a printed circuit board side and it mounts in a printed circuit board by not forming the external electrode layer 20 in the rear face of a substrate 11, the effectiveness that the high rate of mounting is securable is acquired. Moreover, the 1st protective layer 22 which a protective coat 21 becomes from oxides with thermal resistance, such as an alumina and a silica, Since a resistive layer 14 is covered by the protective coat 21 which was excellent in thermal resistance and moisture resistance by constituting from the 2nd protective layer 23 which consists of the existing phenol system or epoxy resin of the moisture resistance formed in the top face of the 1st protective layer 22, A resistive layer 14 does not need to be influenced of heat or moisture, and, thereby, the effectiveness that the rate of a change in resistance at the time of use can be made small is also acquired. Furthermore, since the touch area of the external electrode layer 20 and the top-face electrode layer 15 becomes large by forming the external electrode layer 16 in the top face of the top-face electrode layer 15, even if it receives environmental loads, such as a thermal shock, the increment in contact resistance in the meantime can be suppressed, and thereby, since a resistive layer 14 can make small the rate of the increment of the contact resistance to the resistance of a resistive layer 14 also in low resistance value, the effectiveness that the rate of a change in resistance can be made low is also acquired.

[0054] About the resistor in the gestalt 1 of operation of this invention constituted as mentioned above, the manufacture approach is explained below, referring to a drawing.

[0055] Drawing 2 - drawing 8 are drawings showing the manufacture approach of the resistor in the gestalt 1 of operation of this invention. In addition, in each drawing, (b) is a plan, (a) is the B-B line sectional view of (b), and (d) and (f of a plan, (c), and (e)) are the B-B line sectional views of (d) and (f) like this, respectively.

[0056] First, as shown in drawing 2 (a) and (b), the substrate 11 which consists of an ingredient of resin systems, such as resin, a resin compound, and resin mixture, is prepared (in addition, this substrate 11 says the substrate of the shape of a bigger sheet than one resistor, in order to manufacture two or more resistors.). In order to obtain one resistor, it is necessary to divide the substrate of the shape of this sheet. .

[0057] In addition, the thickness of a substrate 11 has 0.05mm - 0.25

desirablemm. Since the substrate 11 is as thin as 0.25mm or less, wear of the cutting edge at the time of substrate cutting can be suppressed small. However, if set to 0.05mm or less, it will be hard to form a resistive layer 14 etc., or the handling of substrate 11 the very thing becomes difficult.

[0058] Next, as shown in drawing 2 (c) and (d), the substrate layer 13 which consists of oxides, such as an alumina, is formed in the top face of a substrate 11.

[0059] Next, as shown in drawing 2 (e) and (f), pattern NINGU of the substrate layer 13 is carried out according to a FOTORISO process. At this time, it leaves except the periphery section (part in which the fluting 28 for division mentioned later and a transverse groove 29 are formed) of the field equivalent to one resistor (part which has one independent resistive layer 14).

[0060] Next, as shown in drawing 3 (a) and (b), a resistive layer 14 is formed in the top face of the substrate layer 13 and the substrate 11 which does not have the substrate layer 13 in a top face by the spatter.

[0061] Next, as shown in drawing 3 (c) and (d), the top-face electrode layer 15 which consists of an ingredient of a golden system by the spatter all over resistive layer 14 top face is formed. In addition, a rear-face electrode may be prepared in the rear face of a substrate 11 if needed.

[0062] Next, as shown in drawing 3 (e) and (f), pattern NINGU of the top-face electrode layer 15 is carried out with a FOTORISO method of construction. At this time, the top-face electrode layer 15 is formed in the both ends of resistive layer 14 top face in the field equivalent to one resistor (part which has one independent resistive layer 14). It is made for the top-face electrode layer 15 not to continue in the field equivalent to one more resistor (part which has one independent resistive layer 14).

[0063] Next, as shown in drawing 4 (a) and (b), in order to make it target resistance, pattern NINGU of the resistive layer 14 is carried out with a FOTORISO process, laser, etc. if needed. Furthermore, it is made to be formed only in substrate layer 13 top face which remains in addition to the periphery section of the field in which a resistive layer 14 is equivalent to one resistor (part which has one independent resistive layer 14). It is made for the top-face electrode layer 15 formed in the top face of a resistive layer 14 and a resistive layer 14 not to straddle a transverse groove 29 ranging over the fluting 28 for division prepared at a back process at this time.

[0064] After forming the top-face electrode layer 15 and a resistive layer 14 by the spatter, thus, by having been made to carry out pattern NINGU with a FOTORISO method of construction at a predetermined configuration, respectively Since pattern formation of the resistive layer 14 is carried out with high precision by the FOTORISO process in addition to becoming easy to divide a substrate 11 in the fluting 28 or transverse groove 29 for division

since the top-face electrode layer 15 and a resistive layer 14 can be formed thinly, Effective area of a resistive layer 14 can be enlarged, and thereby, even if high power is impressed, the effectiveness that the rate of a change in resistance can be made low is acquired.

[0065] Next, as shown in drawing 4 (c) and (d), in order to adjust the resistance between the top-face electrode layers 15 in the field equivalent to one resistor (part which has one independent resistive layer 14), the trimming slot 24 is formed by laser trimming if needed.

[0066] Next, as shown in drawing 4 (e) and (f), the resist layer 25 is formed in some top faces of the top-face electrode layer 15 by screen-stencil so that a resistive layer 14 may be exposed at least. It hardens at 150 degrees C and the temperature for 10 minutes so that the resist layer 25 may be stabilized after this.

[0067] Next, as shown in drawing 5 (a) and (b), the 1st protective layer 22 which consists of oxides, such as an alumina, by the spatter is formed in a part of exposed resistive layer 14, top-face electrode layer 15, and the top face of the resist layer 25.

[0068] Next, as shown in drawing 5 (c) and (d), lift off of the resist layer 25 is carried out, and pattern NINGU of the 1st protective layer 22 is carried out.

[0069] Thus, since the substrate layer 13 and a protective coat 21 can be precisely formed by forming the 1st protective layer 22 by the spatter at least among the substrate layer 13 and a protective coat 21, moisture stops being able to enter easily to a resistive layer 14, and, thereby, the effectiveness that a resistive layer is stabilized is acquired.

[0070] Next, as shown in drawing 5 (e) and (f), the 2nd protective layer 23 which consists of resin is formed in the top face of the 1st protective layer 22 by screen-stencil. It hardens at 180 degrees C and the temperature for 30 minutes so that the 2nd protective layer 23 may be stabilized after this. At this time, the protective coat 21 which consists of the 1st protective layer 22 and 2nd protective layer 23 covers a resistive layer 14 at least.

[0071] Thus, the 2nd protective layer 23 can be cheaply formed by forming the 2nd protective layer 23 by screen-stencil.

[0072] Next, as shown in drawing 6 (a) and (b), a through tube 26 is formed in the both ends of the substrate 11 in the field equivalent to one resistor (part which has one independent resistive layer 14). Namely, what is necessary is just to make it a through tube 26 not straddle a transverse groove 29 ranging over the fluting 28 for division prepared at a back process. In addition, this through tube 26 is equivalent to the notching section 12 in drawing 1 .

[0073] Next, as shown in drawing 6 (c) and (d), it is filled up with the mixed paste which becomes a through tube 26 from metal powder and resin, and the end-face electrode layer 16 is formed. It hardens at 200 degrees C and the temperature for 30 minutes so that 16 of an end-face electrode layer

may be stabilized after this. At this time, the end-face electrode layer 16 is formed in the both-ends side of a substrate 11 so that it may connect with each end face of a resistive layer 14 and the top-face electrode layer 15 electrically.

[0074] Thus, a through tube 26 is formed so that the part used as the fluting 28 of a substrate 11 may be straddled and a transverse groove 29 may not be straddled. By making it connect with the top-face electrode layer 15 electrically, and having formed the end-face electrode layer 16, while making the through tube 26 fill up with a conductor Since the end-face electrode layer 16 can be formed in the field equivalent to one resistor surrounded by the fluting 28 and the transverse groove 29, Rather than what formed the end-face electrode layer 16 after dividing a substrate 11 in the shape of a piece of an individual, the end-face electrode layer 16 can miniaturize the resistor by which only the part which does not project from a substrate 11 included the end-face electrode layer 16.

[0075] Furthermore, since it formed by stiffening the mixed paste which becomes a through tube 26 from metal powder and resin about the end-face electrode layer 16, the end-face electrode layer 16 can be calcinated at the low temperature of 130 degrees C - 240 degrees C, thereby, the effect of the heat to a resistive layer 14 can be suppressed, and the effectiveness that the resistance value change under production can be made small is acquired.

[0076] Moreover, the end-face electrode layer 16 may be formed by the spatter instead of being filled up with the conductor which becomes a through tube 26 from metal powder and resin as described above. Since in addition to the effectiveness described above at this time the end-face electrode layer 16 can be formed very thinly even if a through tube 26 is small, the end-face electrode layer 16 enters certainly in a through tube 26, and the effectiveness that it is stabilized and the end-face electrode layer 16 can be formed by this can also be expected.

[0077] Next, after adhesives stick on it the sheet bridging 27 by which the adhesives which have an ultraviolet curing property were formed in one side all over substrate 11 inferior surface of tongue as they contact a substrate 11 as shown in drawing 6 (e) and (f), the fluting 28 for division is formed. It is made for a resistive layer 14, the top-face electrode layer 15, and the end-face electrode layer 16 to straddle a fluting 28 at this time.

[0078] Next, as shown in drawing 7 (a) and (b), the transverse groove 29 for division is formed. It is made for a resistive layer 14, the top-face electrode layer 15, and the end-face electrode layer 16 not to straddle a transverse groove 29 at this time.

[0079] Of course, after preparing what is formed at the end among components, such as a resistive layer 14 and the top-face electrode layer

15, (protective coat 21 in this case), after the direction which formed the fluting 28 for division and the transverse groove 29, and divided the substrate 11 divides a substrate 11, it is efficient rather than it prepares each one component at a time.

[0080] The fluting 28 for this division and a transverse groove 29 are formed a dicing process and by irradiating an excimer laser. In addition, if an excimer laser is used, since the fluting 28 and transverse groove 29 certainly [the part by which laser was irradiated] for division to a high speed can be formed, productivity will improve.

[0081] Moreover, the fluting 28 and transverse groove 29 for division are formed in a part of substrate 11 and sheet bridging 27. Of course, the fluting 28 and transverse groove 29 for division are formed to the middle of a substrate 11, and a substrate 11 is divided and you may make it obtain the resistor of the shape of two or more piece of an individual with a dicing method of construction etc. after that.

[0082] In addition, the end-face electrode layer 16 may be formed in the fluting 28 for division, and a transverse groove 29 by the spatter instead of forming the end-face electrode layer 16 by being filled up with the conductor which becomes a through tube 26 from metal powder and resin, or carrying out a spatter, as described above, without forming a through tube 26. Since the end-face electrode layer 16 can be formed very thinly at this time, the end-face electrode layer 16 enters into division Mizouchi certainly, thereby, it is stabilized and the end-face electrode layer 16 can be formed.

[0083] Next, as shown in drawing 7 (c) and (d), irradiate ultraviolet rays, the sheet bridging 27 is made to separate from a substrate 11, a substrate 11 is divided along the fluting 28 and transverse groove 29 for division, and it divides into the resistor of the shape of two or more piece of an individual.

[0084] Thus, by having established the fluting 28 and transverse groove 29 for division in the substrate 11, making the sheet bridging 27 separate from a substrate 11 after that, and having divided the substrate 11, after sticking the sheet bridging 27 on a substrate 11 A location gap is caused when one side is prepared among the fluting 28 for division, and a transverse groove 29. Cannot establish the slot for another division in a position, or When a substrate 11 is divided, each piece of individual-like resistors are scattered scatteringly, and the effectiveness that it can prevent that a next process becomes complicated is acquired. Moreover, the adhesive strength of the sheet bridging 27 can be lost at high speed by irradiating ultraviolet rays, since the thing containing the adhesives which have an ultraviolet curing property as a sheet bridging 27 was used, and thereby, since the adhesive strength of the sheet bridging 27 can be lost fundamentally in addition to productivity improving, the sheet bridging 27 is certainly separable from a substrate 11. Furthermore, since the process into which the sheet bridging

27 is made to separate from a substrate 11 is performed by irradiating ultraviolet rays, by irradiating ultraviolet rays, it can lose the adhesive strength of the sheet bridging 27 easily, and, thereby, can separate the sheet bridging 27 from a substrate 11 easily.

[0085] Finally, as shown in drawing 8 (a) and (b), the plating layer 17 which consists of a nickel-plating layer 18 and a low-melt point point metal plating layer 19 is formed in the front face of the end-face electrode layer 16, and the exposed top face of the top-face electrode layer 15.

[0086] Since the substrate 11 which consists of an ingredient of a resin system softer than an alumina was used for the resistor in the gestalt 1 of operation of above-mentioned this invention, wear of the cutting edge for substrate cutting can be suppressed, and, thereby, the effectiveness that the cutting cost of a substrate can be held down is acquired.

[0087] Moreover, in order to divide a substrate 11 after formation of the top-face electrode layer 15, a resistive layer 14, the end-face electrode layer 16, a protective coat 21, etc., the need of classifying a substrate 11 into a dimension rank is lost, and, thereby, the effectiveness that the complicatedness of a process is solved is also acquired.

[0088] Furthermore, in order to divide a substrate 11 after formation of the top-face electrode layer 15, a resistive layer 14, the end-face electrode layer 16, a protective coat 21, etc., in order to form the end-face electrode layer 16 etc., it is not necessary to divide a substrate 11 in the shape of a strip of paper once, the resistor of the shape of two or more piece of an individual can be obtained only by carrying out a batch rate by this, and, thereby, the effectiveness that a process can be simplified is also acquired.

[0089] In addition, in drawing 7 and drawing 8 , although two or more things with which two resistors (part which has one independent resistive layer 14) of the shape of a piece of an individual which became independent by the transverse groove 29 were connected are obtained, as shown in drawing 1 , two or more resistors which have one independent resistive layer 14 by the transverse groove 29 may be made to be obtained. Of course, the above-mentioned effectiveness can be said to all of that (multiple-string chip resistor with which the resistive layer which plurality became independent of is one unit) with which the resistor which has one independent resistive layer, and two or more resistors which have one independent resistive layer like the resistor in the gestalt 2 of operation mentioned later were connected.

[0090] (Gestalt 2 of operation) The resistor in a gestalt 2 and its manufacture approach of operation are explained hereafter, referring to a drawing.

[0091] The perspective view of a resistor [in / in drawing 9 (a) / the gestalt 2 of operation of this invention] and drawing 9 (b) are these C-C line

sectional views. In addition, drawing 9 (a) is omitting the protective coat 21 mentioned later. Moreover, the resistor in the gestalt 2 of operation of this invention is a multiple-string chip resistor with which the resistive layer which the plurality which is one sort of a resistor became independent of is one unit.

[0092] In drawing 9 (a) and (b), 11 is a substrate, has a crevice 30 to both ends, and consists of an ingredient of resin systems, such as resin, a resin compound, and resin mixture. The configuration of this crevice 30 is seen from the upper part of a substrate 11, and has become **** hemicycle-like. Of course, you may be other configurations, such as the shape of a rectangle. 13 is a substrate layer, is prepared in the top face of a substrate 11, and consists of an oxide which uses an alumina as a principal component. 14 is two or more resistive layers, and is prepared in substrate 11 top face through the substrate layer 13. What is necessary is just to select the ingredient of a resistive layer 14 from ruthenium oxide, nickel-Lynn, etc. by target resistance, application, etc. Moreover, two or more resistive layers 14 become independent, respectively, and each other is stationed at the juxtaposition condition.

[0093] In addition, if a liquid crystal polymer is used, since the thing of a suitable coefficient of thermal expansion can be easily chosen as a substrate 11 among the liquid crystal polymers from which a coefficient of thermal expansion differs, relation with the coefficient of thermal expansion of a resistive layer 14 or a printed circuit board can be adjusted, and, thereby, the effectiveness that the curvature of the substrate 11 at the time of use by the difference in a coefficient of thermal expansion etc. can be prevented is acquired. Moreover, since the oxide which uses the alumina of the substrate layer 13 as a principal component can decrease invasion to the substrate 11 of moisture, it is for acquiring the effectiveness of raising the moisture resistance of the substrate 11 which consists of an ingredient of resin systems, such as a liquid crystal polymer which is generally hygroscopic.

[0094] 15 is two or more pairs of top-face electrode layers, is prepared in the both ends of the top face of each resistive layer 14, and consists of an ingredient of a golden system. 16 is two or more pairs of end-face electrode layers, it is formed so that it may connect with each end face of the end-face electrode layer 16 of a pair, and the resistive layer 14 of the pair which corresponds, respectively and the top-face electrode layer 15 of a pair electrically, and it consists of a conductor. If the ingredient which consists of metal powder and resin as this conductor is used, since an end-face electrode layer can be calcinated at the low temperature of 130 degrees C - 240 degrees C, the effect of the heat to a resistive layer can be suppressed, and, thereby, the resistance value change under production can be made small.

[0095] 17 is two or more plating layers, is prepared in a part of front face of each end-face electrode layer 16, and top face of each top-face electrode layer 15 corresponding to each of this end-face electrode layer 16, and consists of a nickel-plating layer (barrier layer) 18 and a low-melt point point metal plating layer 19. Moreover, in the front face of each end-face electrode layer 16, the low-melt point point metal plating layer 19 is formed in the front face of the nickel-plating layer 18 and the nickel-plating layer 18. 20 is two or more external electrode layers, and each external electrode layer 20 consists of an end-face electrode layer 16 and a plating layer 17, is formed in a part of end face of a substrate 11, and top face of the top-face electrode layer 15, and is not prepared in the rear face of a substrate 11. Moreover, the crevice 30 mentioned above is formed in the part located between each external electrode layer 20 in the end face of a substrate 11. 21 is a protective coat, it is prepared so that all the resistive layers 14 may be covered at least, and it consists of the 1st protective layer 22 which consists of oxides, such as an alumina and a silica, and the 2nd protective layer 23 which consists of a phenol system or an epoxy resin. Moreover, the 2nd protective layer 23 is formed in the top face of the 1st protective layer 22 and the 1st protective layer 22 on the top face of each resistive layer 14. Moreover, the top face of each external electrode layer 20 is prepared more nearly up than the top face of a protective coat 21.

[0096] Thus, since the stability at the time of adsorption improves when the rear face of a substrate 11 is adsorbed by the adsorption pin of an automatic mounting machine, the top-face side of a substrate 11 is turned to a printed circuit board side and it mounts in a printed circuit board by not forming the external electrode layer 20 in the rear face of a substrate 11, the effectiveness that the high rate of mounting is securable is acquired. Moreover, the 1st protective layer 22 which a protective coat 21 becomes from oxides with thermal resistance, such as an alumina and a silica, Since a resistive layer 14 is covered by the protective coat 21 which was excellent in thermal resistance and moisture resistance by constituting from the 2nd protective layer 23 which consists of the existing phenol system or epoxy resin of the moisture resistance formed in the top face of the 1st protective layer 22, A resistive layer 14 does not need to be influenced of heat or moisture, and, thereby, the effectiveness that the rate of a change in resistance at the time of use can be made small is also acquired. Furthermore, since the touch area of the external electrode layer 20 and the top-face electrode layer 15 becomes large by forming the external electrode layer 16 in the top face of the top-face electrode layer 15, even if it receives environmental loads, such as a thermal shock, the increment in contact resistance in the meantime can be suppressed, and thereby, since a resistive layer 14 can make small the rate of the increment of the contact resistance

to the resistance of a resistive layer 14 also in low resistance value, the effectiveness that the rate of a change in resistance can be made low is also acquired.

[0097] Moreover, since the crevice 30 was formed in the part located between each external electrode layer 20 in the end face of a substrate 11, In the multiple-string chip resistor with which the resistive layer which plurality like the resistor in the gestalt 2 of operation of this this invention became independent of is one unit The distance in the end face of a substrate (not being the creeping distance) 11 separates by the crevice 30 between each external electrode layer 20 corresponding to each resistive layer 14. By this The effectiveness that it can prevent that external electrode layer 20 comrades contact and resistive layer 14 comrades connect electrically at the time of formation of the external electrode layer 20 is acquired.

[0098] Furthermore, since the top face of the external electrode layer 20 was prepared more nearly up than the top face of a protective coat 21, even if it turns the top-face side of a substrate 11 to a printed circuit board side, in order that the top face of the external electrode 20 may contact a printed circuit board, whichever it turns [of the vertical side of a substrate] to a printed circuit board side, the effectiveness that mounting becomes possible is also acquired.

[0099] About the resistor in the gestalt 2 of operation of this invention constituted as mentioned above, the manufacture approach is explained below, referring to a drawing.

[0100] Drawing 10 - drawing 16 are drawings showing the manufacture approach of the resistor in the gestalt 2 of operation of this invention. In addition, in each drawing, (b) is a plan, (a) is D-D line sectional view of (b), and (d) and (f of a plan, (c), and (e)) are D-D line sectional views of (d) and (f) like this, respectively.

[0101] First, as shown in drawing 10 (a) and (b), the substrate 11 which consists of an ingredient of resin systems, such as resin, a resin compound, and resin mixture, is prepared (in addition, this substrate 11 says the substrate of the shape of a bigger sheet than one resistor, in order to manufacture two or more resistors.). In order to obtain one resistor, it is necessary to divide the substrate of the shape of this sheet. .

[0102] Next, as shown in drawing 10 (c) and (d), the substrate layer 13 which consists of oxides, such as an alumina, is formed in the top face of a substrate 11.

[0103] Next, as shown in drawing 10 (e) and (f), pattern NINGU of the substrate layer 13 is carried out with a FOTORISO method of construction. At this time, it leaves except the periphery section (part in which the fluting 28 for division mentioned later and a transverse groove 29 are formed) of the

field equivalent to one resistor (part which has one independent resistive layer 14).

[0104] Next, as shown in drawing 11 (a) and (b), a resistive layer 14 is formed in the top face of the substrate layer 13 and the substrate 11 which does not have the substrate layer 13 in a top face by the spatter.

[0105] Next, as shown in drawing 11 (c) and (d), the top-face electrode layer 15 which consists of an ingredient of a golden system by the spatter all over resistive layer 14 top face is formed. In addition, a rear-face electrode may be prepared in the rear face of a substrate 11 if needed.

[0106] Next, as shown in drawing 11 (e) and (f), pattern NINGU of the top-face electrode layer 15 is carried out with a FOTORISO method of construction. At this time, the top-face electrode layer 15 is formed in the both ends of resistive layer 14 top face in the field equivalent to one resistor (part which has one independent resistive layer 14). It is made for the top-face electrode layer 15 not to continue in the field equivalent to one more resistor (part which has one independent resistive layer 14).

[0107] Next, as shown in drawing 12 (a) and (b), in order to make it target resistance, pattern NINGU of the resistive layer 14 is carried out with a FOTORISO method of construction, laser, etc. if needed. Furthermore, it is made to be formed only in substrate layer 13 top face which remains in addition to the periphery section of the field in which a resistive layer 14 is equivalent to one resistor (part which has one independent resistive layer 14). It is made for the top-face electrode layer 15 formed in the top face of a resistive layer 14 and a resistive layer 14 not to straddle a transverse groove 29 ranging over the fluting 28 for division prepared at a back process at this time.

[0108] After forming the top-face electrode layer 15 and a resistive layer 14 by the spatter, thus, by having been made to carry out pattern NINGU with a FOTORISO method of construction at a predetermined configuration, respectively Since pattern formation of the resistive layer 14 is carried out with high precision by the FOTORISO process in addition to becoming easy to divide a substrate 11 in the fluting 28 or transverse groove 29 for division since the top-face electrode layer 15 and a resistive layer 14 can be formed thinly, Effective area of a resistive layer 14 can be enlarged, and thereby, even if high power is impressed, the effectiveness that the rate of a change in resistance can be made low is acquired.

[0109] Next, as shown in drawing 12 (c) and (d), in order to adjust the resistance between the top-face electrode layers 15 in the field equivalent to one resistor (part which has one independent resistive layer 14), the trimming slot 24 is formed by laser trimming if needed.

[0110] Next, as shown in drawing 12 (e) and (f), 1st resist layer 25a is prepared in some top faces of the top-face electrode layer 15 by

screen-stencil so that a resistive layer 14 may be exposed at least. It hardens at 150 degrees C and the temperature for 10 minutes so that 1st resist layer 25a may be stabilized after this.

[0111] Next, as shown in drawing 13 (a) and (b), the 1st protective layer 22 which consists of oxides, such as an alumina, by the spatter is formed in a part of exposed resistive layer 14, top-face electrode layer 15, and the top face of 1st resist layer 25a.

[0112] Next, as shown in drawing 13 (c) and (d), lift off of the 1st resist layer 25a is carried out, and pattern NINGU of the 1st protective layer 22 is carried out.

[0113] Thus, since the substrate layer 13 and a protective coat 21 can be precisely formed by forming the 1st protective layer 22 by the spatter at least among the substrate layer 13 and a protective coat 21, moisture stops being able to enter easily to a resistive layer 14, and, thereby, the effectiveness that a resistive layer is stabilized is acquired.

[0114] Next, as shown in drawing 13 (e) and (f), the 2nd protective layer 23 which consists of resin is formed in the top face of the 1st protective layer 22 by screen-stencil. It hardens at 180 degrees C and the temperature for 30 minutes so that the 2nd protective layer 23 may be stabilized after this. At this time, the protective coat 21 which consists of the 1st protective layer 22 and 2nd protective layer 23 covers all the resistive layers 14 at least.

[0115] Thus, the 2nd protective layer 23 can be cheaply formed by forming the 2nd protective layer 23 by screen-stencil.

[0116] Next, as shown in drawing 14 (a) and (b), the 2nd resist layer 31 is formed so that a protective coat 21 may be covered at least.

[0117] Next, after adhesives stick on it the sheet bridging 27 by which the adhesives which have an ultraviolet curing property were formed in one side all over substrate 11 inferior surface of tongue as they contact a substrate 11 as shown in drawing 14 (c) and (d), the fluting 28 for division is formed. It is made for a resistive layer 14, the top-face electrode layer 15, and the end-face electrode layer 16 mentioned later to straddle a fluting 28 at this time.

[0118] Next, as shown in drawing 14 (e) and (f), the end-face electrode layer 16 is formed by the spatter so that the 2nd resist layer 31 exposed to substrate 11 top face, the top-face electrode layer 15, and a fluting 28 may be covered. At this time, the end-face electrode layer 16 enters in a fluting 28.

[0119] Thus, the effectiveness that the end-face electrode layer 16 enters certainly in the division slot 28, it is stabilized in it by this, and the end-face electrode layer 16 can be formed in it since the end-face electrode layer 16 can be formed in the fluting 28 for division very thinly by having formed the

end-face electrode layer 16 by the spatter is acquired.
[0120] Next, as shown in drawing 15 (a) and (b), lift off of the 2nd resist layer 31 is carried out, and all the protective coats 21 are exposed.
[0121] Next, as shown in drawing 15 (c) and (d), the transverse groove 29 for division is formed. It is made for a resistive layer 14, the top-face electrode layer 15, and the end-face electrode layer 16 not to straddle a transverse groove 29 at this time.
[0122] The fluting 28 for this division and a transverse groove 29 are formed a dicing method of construction and by irradiating an excimer laser. In addition, if an excimer laser is used, since the fluting 28 and transverse groove 29 certainly [the part by which laser was irradiated] for division to a high speed can be formed, productivity will improve.
[0123] Moreover, the fluting 28 and transverse groove 29 for division are formed in a part of substrate 11 and sheet bridging 27. Of course, the fluting 28 and transverse groove 29 for division are formed in a substrate 11 to the middle, and a substrate 11 is divided and you may make it obtain two or more resistors with a dicing method of construction etc. after that.
[0124] In addition, the end-face electrode layer 16 may be formed by being filled up with the conductor which becomes a through tube 26 from metal powder and resin like the resistor in the gestalt 1 of operation of this invention, or carrying out a spatter instead of forming the end-face electrode layer 16 in the fluting 28 for division, and a transverse groove 29 by the spatter, as described above. Since the end-face electrode layer 16 can be formed in the field which is equivalent to one resistor surrounded by the fluting 28 and the transverse groove 29 at this time, the end-face electrode layer 16 can miniaturize the resistor by which only the part which does not project from a substrate 11 included the end-face electrode layer 16 rather than what formed the end-face electrode layer 16 after dividing a substrate 11 in the shape of a piece of an individual. Moreover, if it forms so that the end-face electrode layer 16 may bury the through tube 26 (equivalent to the notching section 12) whole, since the cross section of the external electrode layer 20 can be enlarged, bonding strength with a printed circuit board can be raised.
[0125] Thus, if a through tube 26 is formed and the end-face electrode layer 16 is formed in this part, the notching section 12 and a crevice 30 will be formed in the end face of a substrate 11.
[0126] Next, between the fields equivalent to one resistor (part which has one independent resistive layer 14), as shown in drawing 15 (e) and (f), a crevice 30 is formed so that a transverse groove 29 may be included. It is made for the fields equivalent to one resistor (part which has one independent resistive layer 14) not to separate by the crevice 30 at this time.

[0127] Next, as shown in drawing 16 (a) and (b), irradiate ultraviolet rays, the sheet bridging 27 is made to separate from a substrate 11, a substrate 11 is divided along the fluting 28 for division, and the transverse groove 29 in which the crevice 30 is not formed, and it divides into two or more resistors.
[0128] In addition, the number of the independent resistive layers 14 contained in one unit can be selected by specifying the location of the transverse groove 29 in which a crevice 30 is established.
[0129] Thus, by having established the fluting 28 and transverse groove 29 for division in the substrate 11, making the sheet bridging 27 separate from a substrate 11 after that, and having divided the substrate 11, after sticking the sheet bridging 27 on a substrate 11 A location gap is caused when one side is prepared among the fluting 28 for division, and a transverse groove 29. Cannot establish the slot for another division in a position, or When a substrate 11 is divided, each piece of individual-like resistors are scattered scatteringly, and the effectiveness that it can prevent that a next process becomes complicated is acquired. Moreover, the adhesive strength of the sheet bridging 27 can be lost at high speed by irradiating ultraviolet rays, since the thing containing the adhesives which have an ultraviolet curing property as a sheet bridging 27 was used, and thereby, since the adhesive strength of the sheet bridging 27 can be lost fundamentally in addition to productivity improving, the sheet bridging 27 is certainly separable from a substrate 11. Furthermore, since the process into which the sheet bridging 27 is made to separate from a substrate 11 is performed by irradiating ultraviolet rays, by irradiating ultraviolet rays, it can lose the adhesive strength of the sheet bridging 27 easily, and, thereby, can separate the sheet bridging 27 from a substrate 11 easily.
[0130] Finally, as shown in drawing 16 (c) and (d), the plating layer 17 which consists of a nickel-plating layer 18 and a low-melt point point metal plating layer 19 is formed in the front face of the end-face electrode layer 16, and the exposed top face of the top-face electrode layer 15.
[0131] It is made for the top face of each external electrode layer 20 to become the upper part from the top face of a protective coat 21 at this time.

[0132] Drawing 17 is the sectional view showing what turned the top-face side of a substrate 11 to the printed circuit board 32, and mounted the resistor in the gestalt 2 of operation of this invention in the printed circuit board 32.
[0133] Usually, although the inferior-surface-of-tongue side of a substrate is turned to a printed circuit board side, and an external electrode is contacted to a printed circuit board and mounted, in order that the top face of the external electrode 20 may contact a printed circuit board 32 through the solder 33 for mounting even if it turns the top-face side of a substrate 11 to

a printed circuit board side so that clearly from drawing 17 , mounting becomes possible whichever it turns [of the vertical side of a substrate] to a printed circuit board side. In addition, such effectiveness can be said to both the resistor which has one independent resistive layer, and the multiple-string chip resistor with which the resistive layer which plurality became independent of is one unit.

[0134] Since the substrate 11 which consists of an ingredient of a resin system softer than an alumina was used for the resistor in the gestalt 2 of operation of above-mentioned this invention, wear of the cutting edge for substrate cutting can be suppressed, and, thereby, the effectiveness that the cutting cost of a substrate can be held down is acquired.

[0135] Moreover, in order to divide a substrate 11 after formation of the top-face electrode layer 15, a resistive layer 14, the end-face electrode layer 16, a protective coat 21, etc., the need of classifying a substrate 11 into a dimension rank is lost, and, thereby, the effectiveness that the complicatedness of a process is solved is also acquired.

[0136] Furthermore, in order to divide a substrate 11 after formation of the top-face electrode layer 15, a resistive layer 14, the end-face electrode layer 16, a protective coat 21, etc., in order to form the end-face electrode layer 16 etc., it is not necessary to divide a substrate 11 in the shape of a strip of paper once, the resistor of the shape of two or more piece of an individual can be obtained only by carrying out a batch rate by this, and, thereby, the effectiveness that a process can be simplified is also acquired.

[0137] In addition, although the resistor in the gestalt 2 of operation of above-mentioned this invention explained the multiple-string chip resistor with which two independent resistive layers are one unit, it cannot be overemphasized that the effectiveness that the independent resistive layer is the same also about three or more multiple-string chip resistors is acquired.

[0138]

[Effect of the Invention] It is what is characterized by for the resistor of this invention having a substrate, the resistive layer prepared in the top face of said substrate, and the top-face electrode layer of the pair prepared in the both ends of the top face of said resistive layer, and said substrate consisting of an ingredient of a resin system as mentioned above. Since the substrate which consists of an ingredient of a resin system softer than an alumina was used according to this configuration, wear of the cutting edge for substrate cutting can be suppressed, and, thereby, operation that the cutting cost of a substrate can be held down is acquired.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] (a) The perspective view of the resistor in the gestalt 1 of operation of this invention
(b) The A-A line sectional view of this resistor
[Drawing 2] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 3] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 4] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 5] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 6] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 7] (a) Drawing showing the manufacture approach of the -(d) said resistor
[Drawing 8] Drawing showing the manufacture approach of (a) and the (b) said resistor
[Drawing 9] (a) The perspective view of the resistor in the gestalt 2 of operation of this invention
(b) The C-C line sectional view of this resistor
[Drawing 10] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 11] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 12] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 13] (a) Drawing showing the manufacture approach of the -(f) said resistor

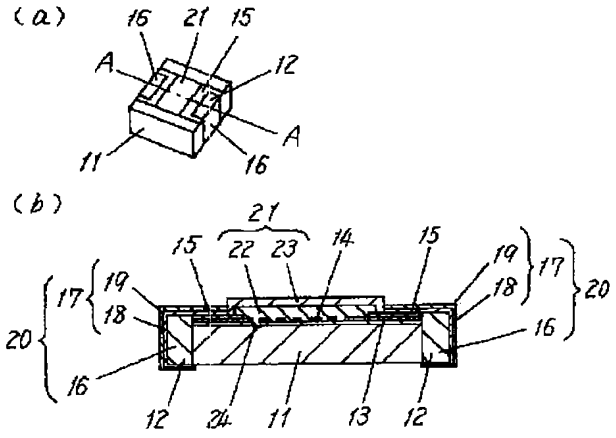
[Drawing 14] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 15] (a) Drawing showing the manufacture approach of the -(f) said resistor
[Drawing 16] (a) Drawing showing the manufacture approach of the -(d) said resistor
[Drawing 17] The sectional view showing what turned the top-face side of a substrate to the printed circuit board, and mounted this resistor in the printed circuit board
[Drawing 18] (a) The perspective view of the conventional resistor
(b) The E-E line sectional view of this resistor
[Drawing 19] Drawing showing the manufacture approach of (a) and the (b) said resistor
[Drawing 20] Drawing showing the manufacture approach of (a) and the (b) said resistor
[Description of Notations]
11 Substrate
12 Notching Section
13 Substrate Layer
14 Resistive Layer
15 Top-Face Electrode Layer
16 End-Face Electrode Layer
17 Plating Layer
20 External Electrode Layer
21 Protective Coat
22 1st Protective Layer
23 2nd Protective Layer
26 Through Tube
27 Sheet Bridging
28 Fluting
29 Transverse Groove
30 Crevice

[Translation done.]

DRAWINGS

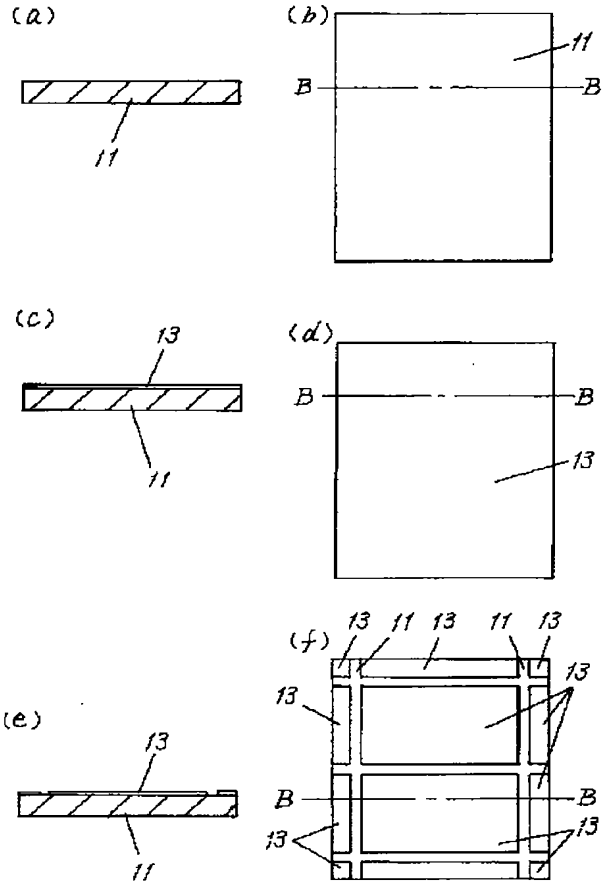
[Drawing 1]

11 基 板
12 切り欠き部
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
17 めっき層
20 外部電極層
21 保護膜
22 第1の保護層
23 第2の保護層



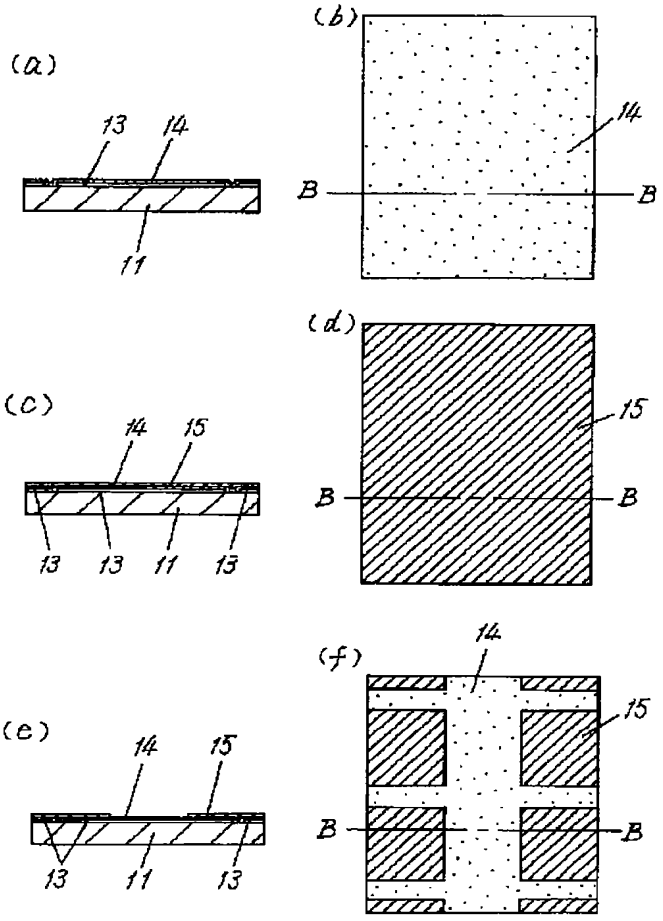
[Drawing 2]

11 基 板
13 下地層

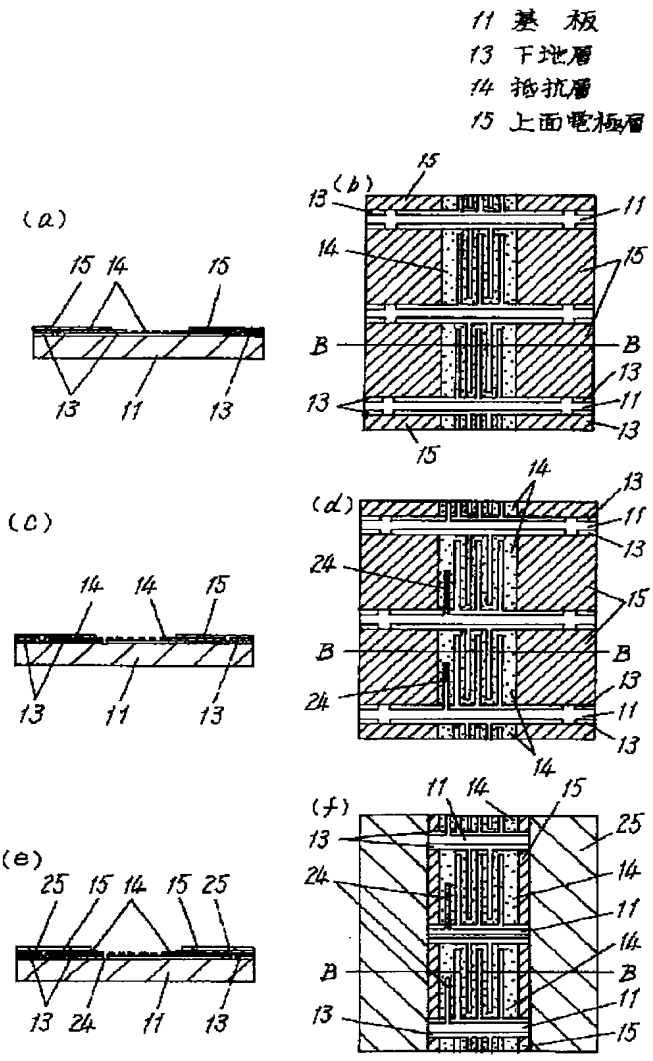


[Drawing 3]

11 基　板
13 下地層
14 抵抗層
15 上面電極層

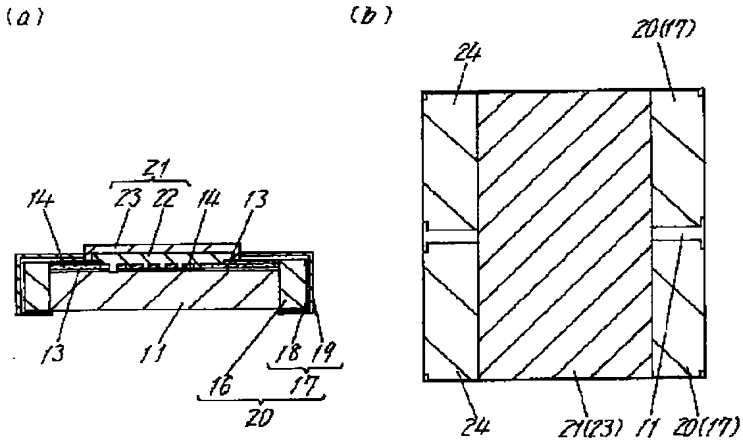


[Drawing 4]



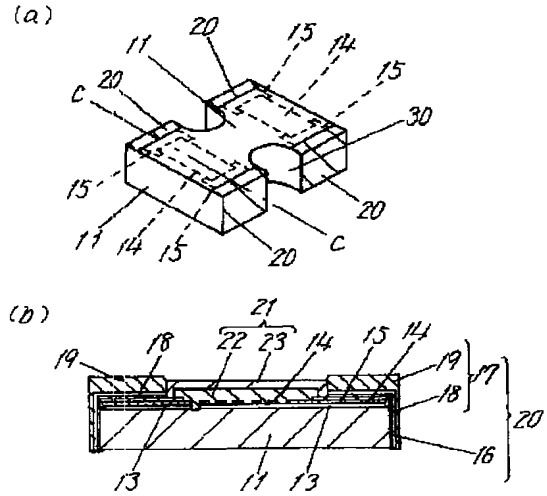
[Drawing 8]

11 基　板　　17 めっき層
13 下地層　　20 外部電極層
14 抵抗層　　21 保護膜
15 上面電極層　22 第1の保護層
16 端面電極層　23 第2の保護層



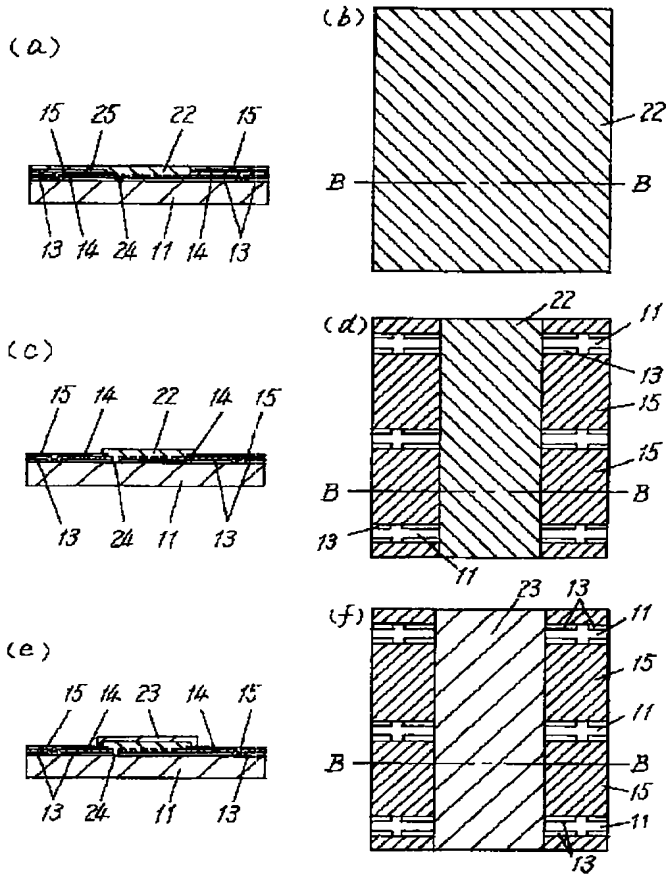
[Drawing 9]

11 基　板　　20 外部電極層
13 下地層　　21 保護膜
14 抵抗層　　22 第1の保護層
15 上面電極層　23 第2の保護層
16 端面電極層　30 凹　部
17 めっき層



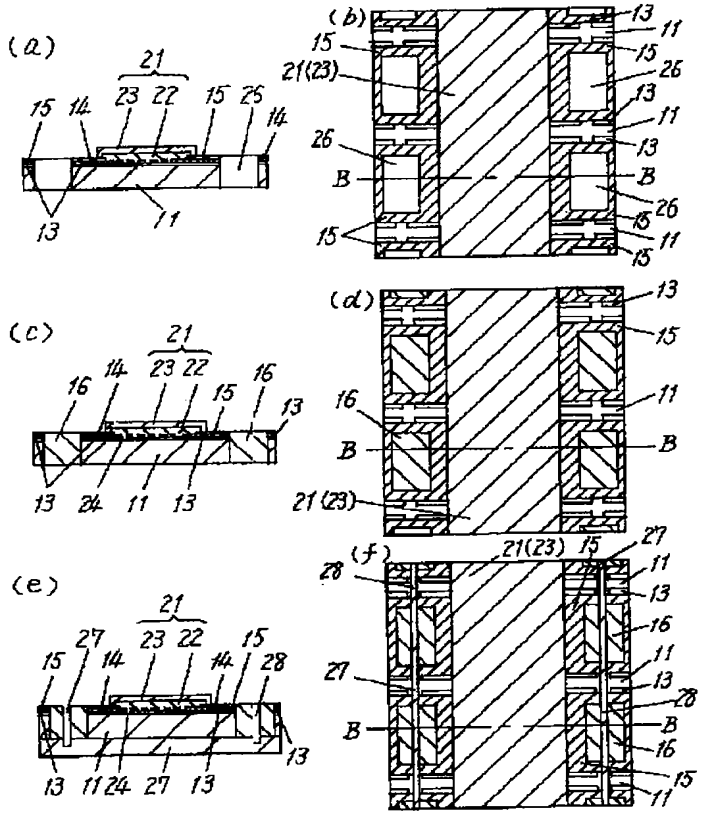
[Drawing 5]

11 基　板　15 上面電極層
13 下地層　22 第1の保護層
14 抵抗層　23 第2の保護層



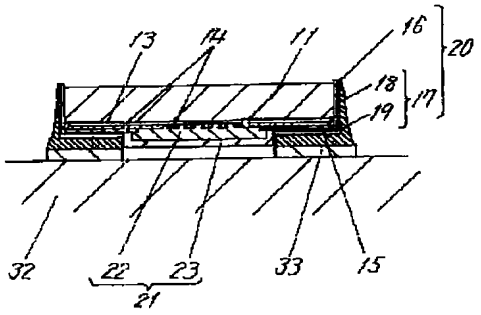
[Drawing 6]

11 基　板　　22 第1の保護層
13 下地層　　23 第2の保護層
14 抵抗層　　26 貫通孔
15 上面電極層　27 シート固定材
16 端面電極層　28 溝　溝
21 保護膜



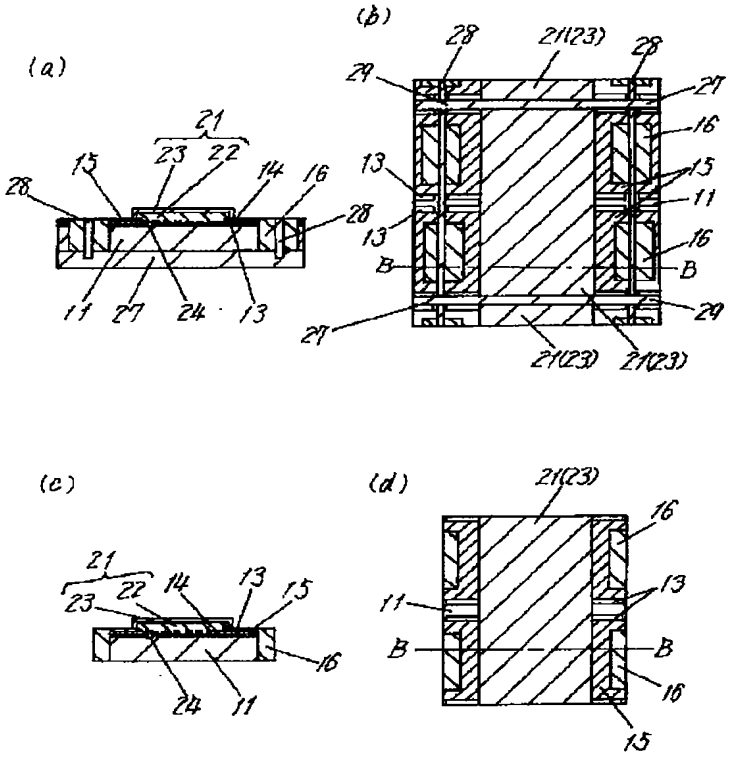
[Drawing 17]

11 基　板
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
17 めっき層
20 外部電極層
21 保護膜
22 第１の保護層
23 第２の保護層

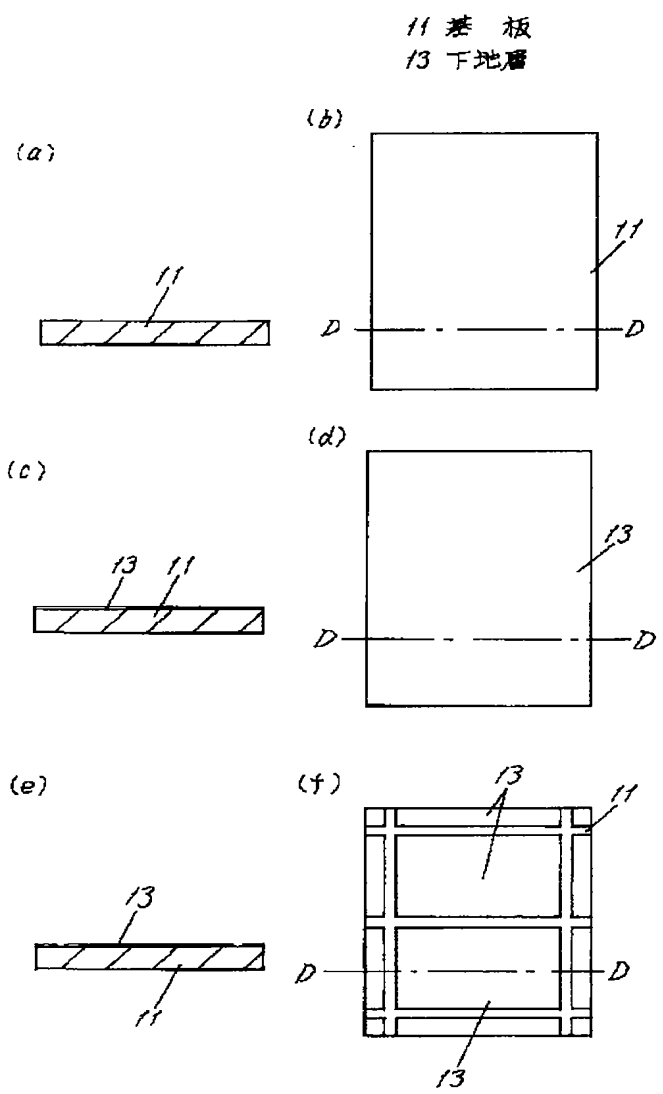


[Drawing 7]

11 基　板　　22 第1の保護層
13 下地層　　23 第2の保護層
14 抵抗層　　27 シート固定材
15 上面電極層　28 縦　溝
21 保護膜　　29 横　溝

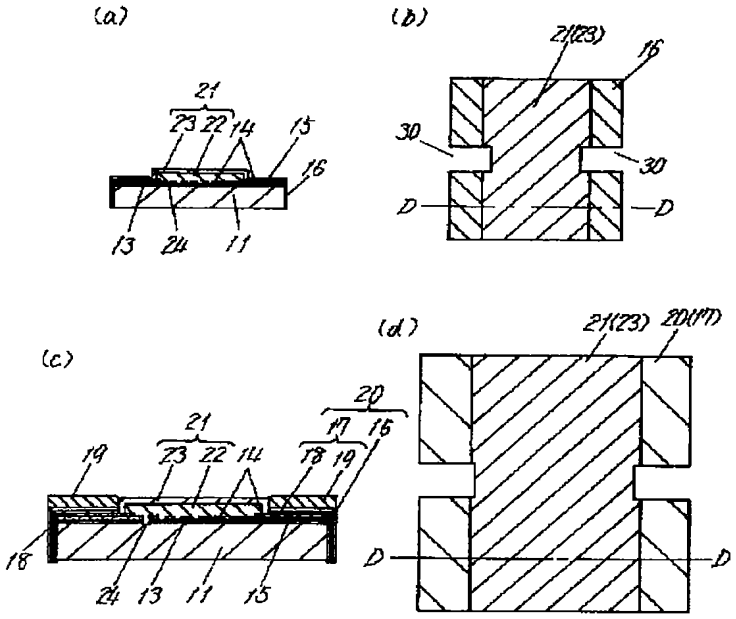


[Drawing 10]



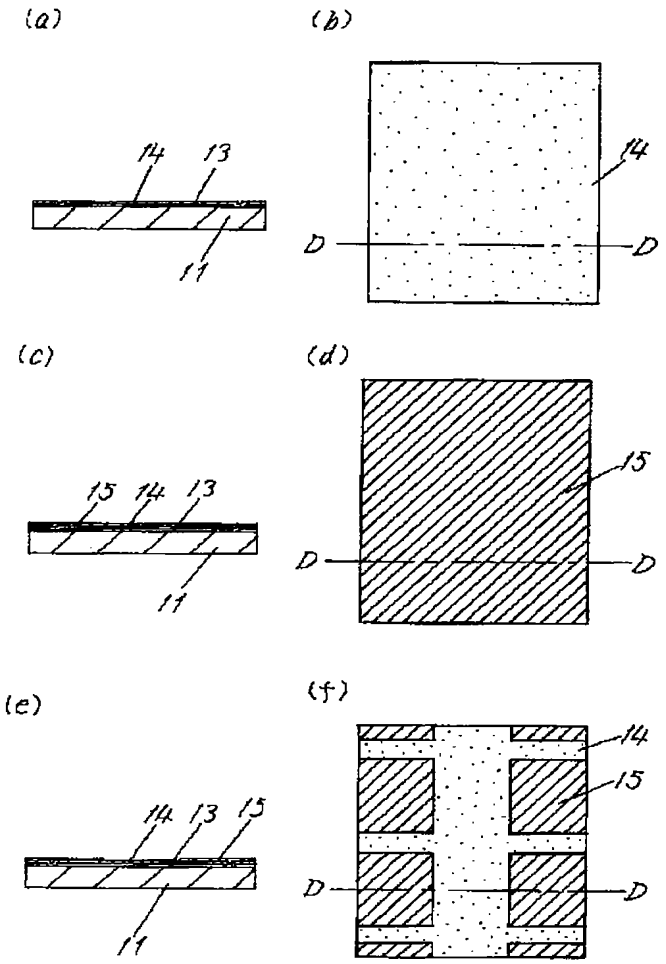
[Drawing 16]

11 基　板　　17 めっき層
13 下地層　　20 外部電極層
14 抵抗層　　21 保護膜
15 上面電極層　　22 第１の保護層
16 端面電極層　　23 第２の保護層

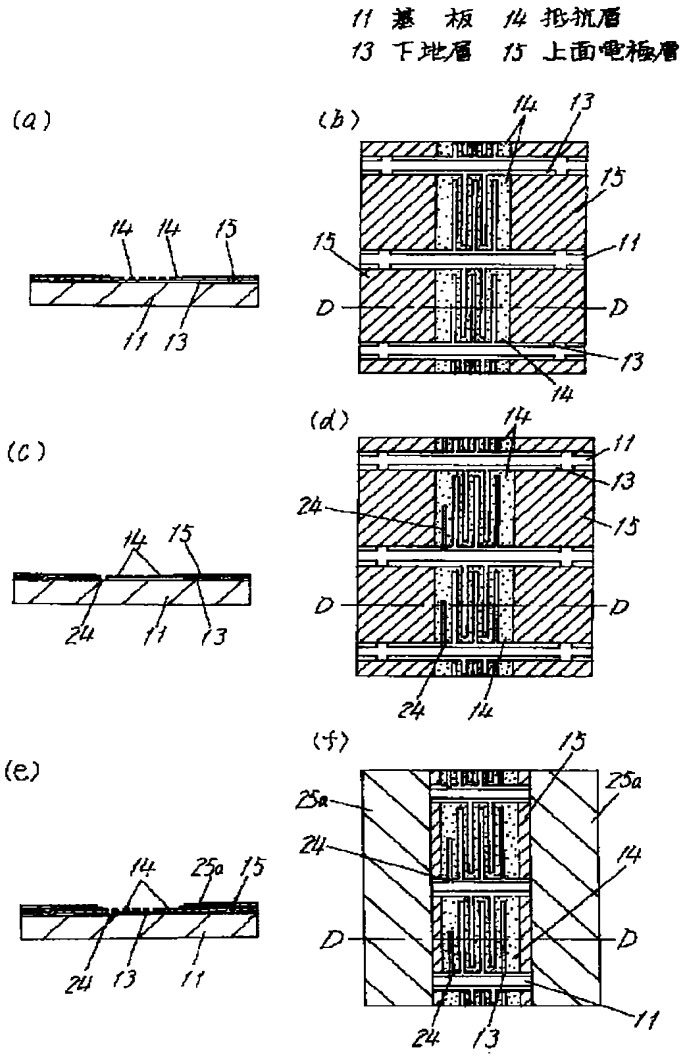


[Drawing 11]

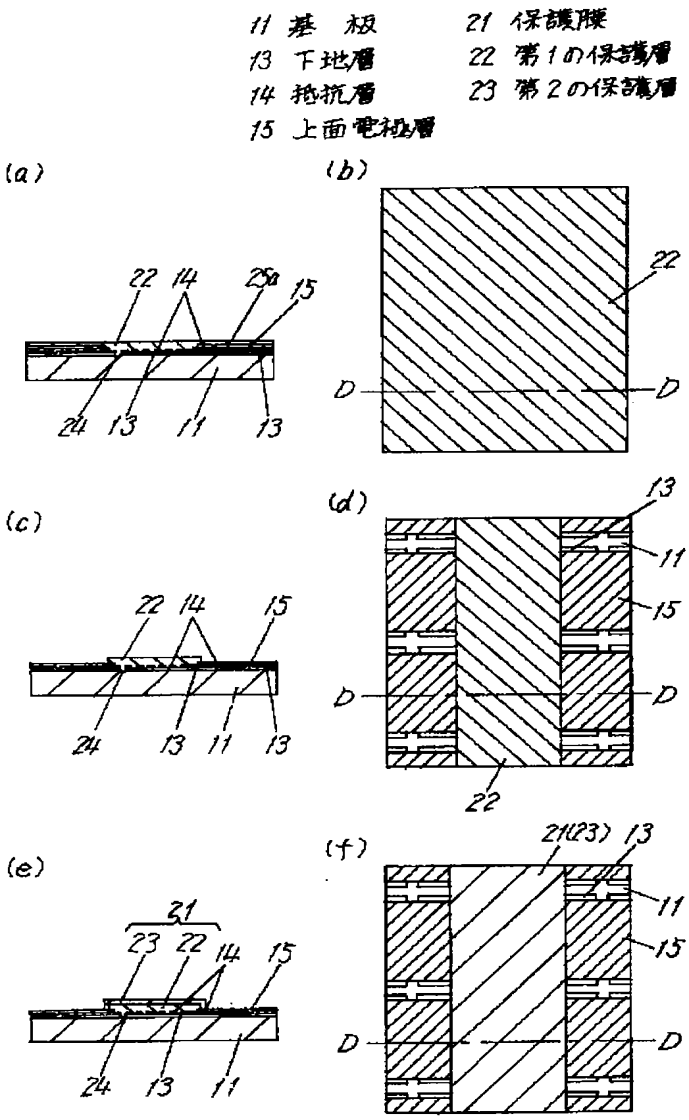
11 基 板 14 抵抗層
13 下地層 15 上面電極層



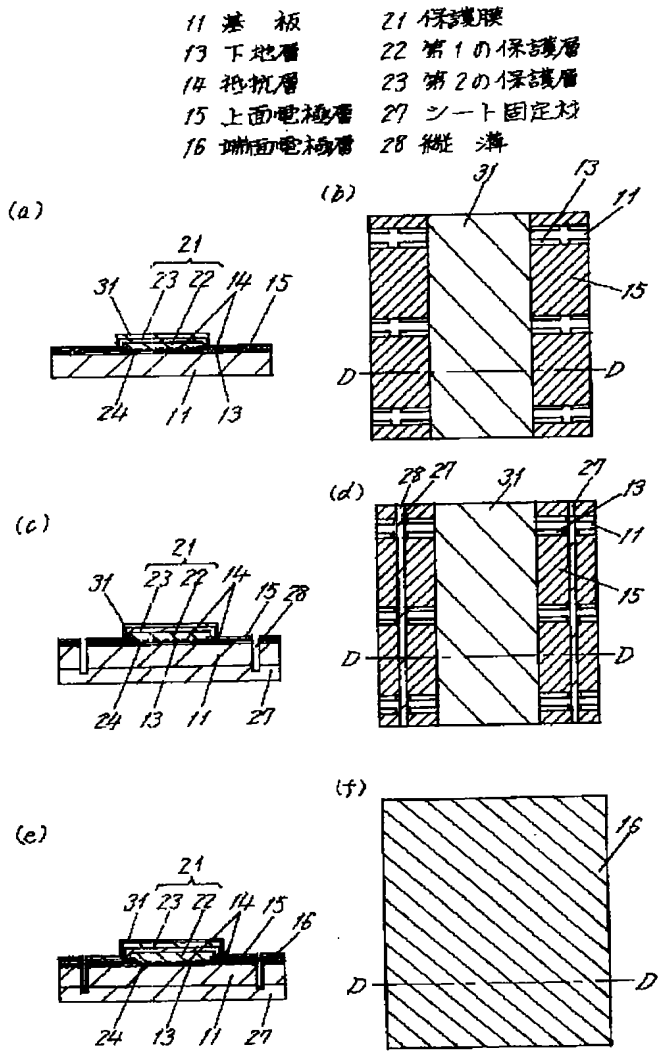
[Drawing 12]



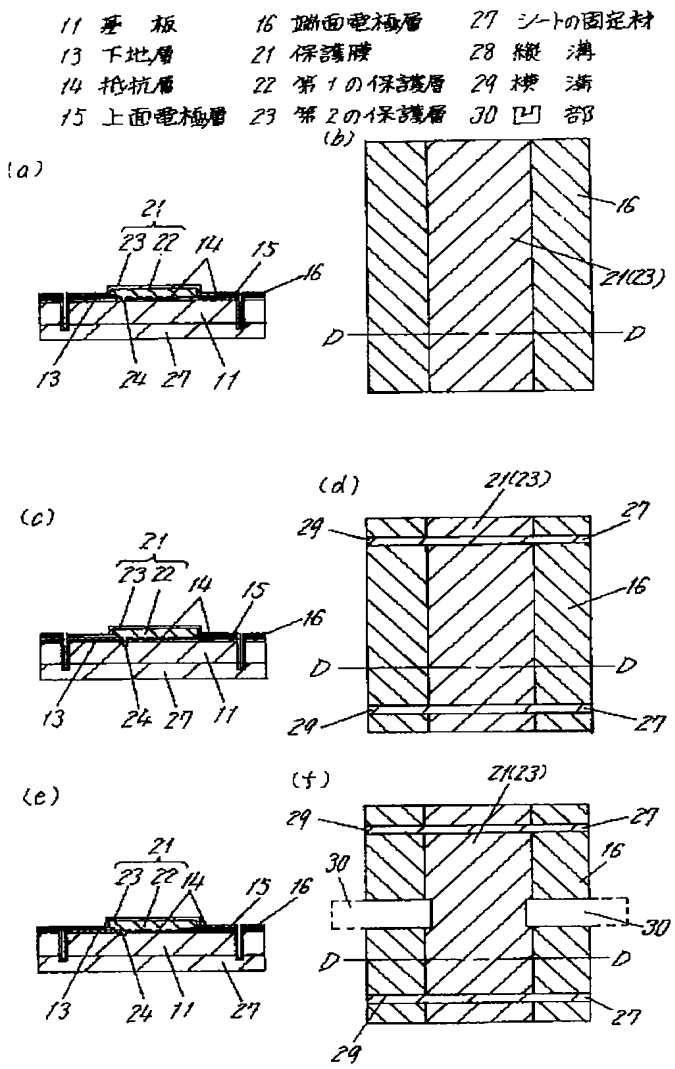
[Drawing 13]


11 基 板
13 下地層
14 抵抗層
15 上面電極層
21 保護膜
22 第1の保護層
23 第2の保護層
(a)
(b)
(c)
(d)
(e)
(f)
D
D
21(23)

[Drawing 14]

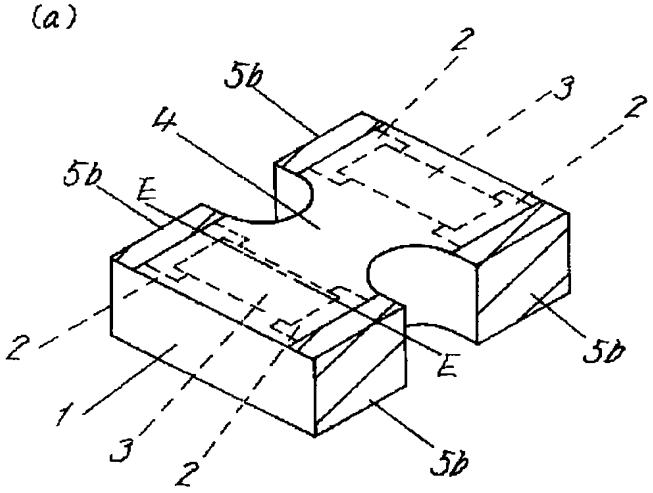

11 基板
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
21 保護膜
22 第1の保護層
23 第2の保護層
27 シート固定材
28 縦溝
(a)
(b)
(c)
(d)
(e)
(f)
D
D

[Drawing 15]

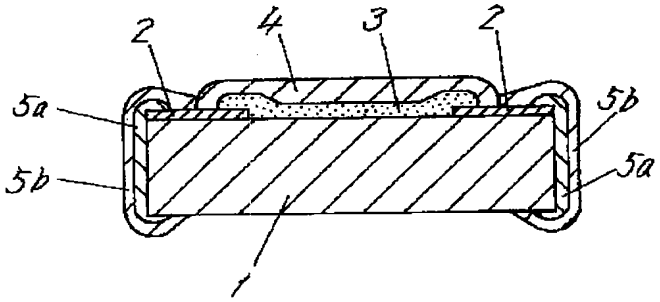

11 基板
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
21 保護膜
22 第1の保護層
23 第2の保護層
27 シートの固定材
28 縦溝
29 横溝
30 凹部
(a)
(b)
(c)
(d)
(e)
(f)
21
23 22 14 15
16
13 24 27 11
21(23)
D
29
30

[Drawing 18]

(a)

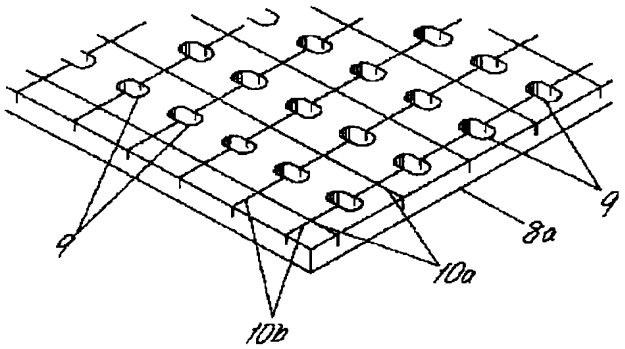


(b)

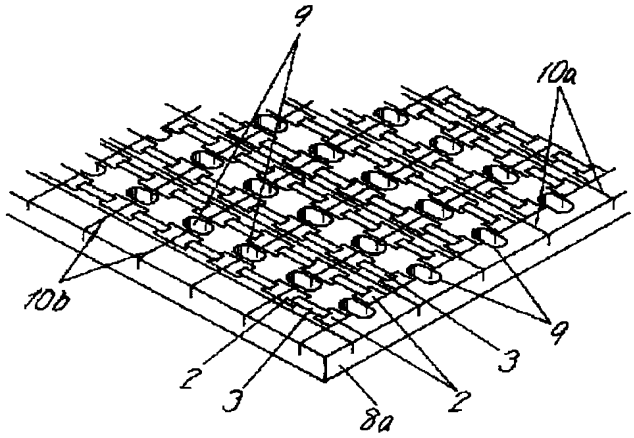


[Drawing 19]

(a)

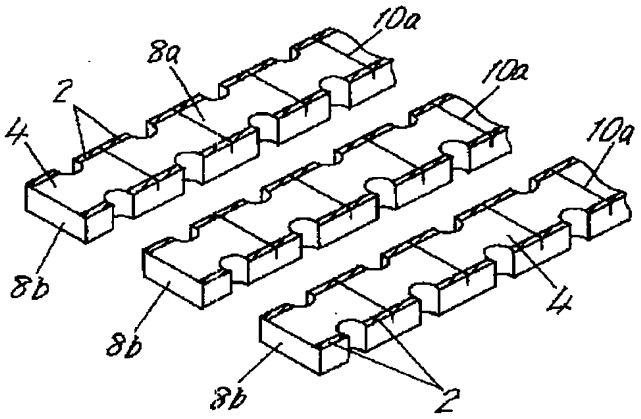


(b)

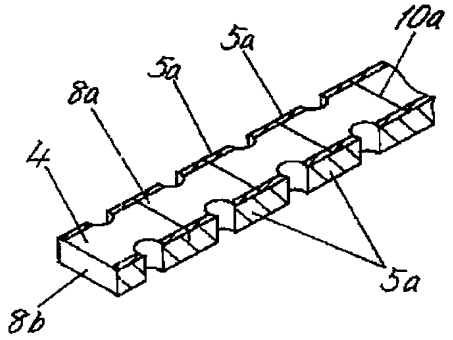


[Drawing 20]

(a)



(b)



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号
特開2001－167902
（P2001－167902A）
(43)公開日　平成13年６月22日(2001.6.22)

(51)Int.Cl.⁷	識別記号	ＦＩ		テーマコード（参考）
Ｈ０１Ｃ　7/00		Ｈ０１Ｃ　7/00	Ｂ	５Ｅ０３２
17/06		17/06	Ｋ	５Ｅ０３３
			Ｖ	

審査請求　未請求　請求項の数23　ＯＬ　（全 20 頁）

(21)出願番号　特願平11－351284

(22)出願日　平成11年12月10日(1999.12.10)

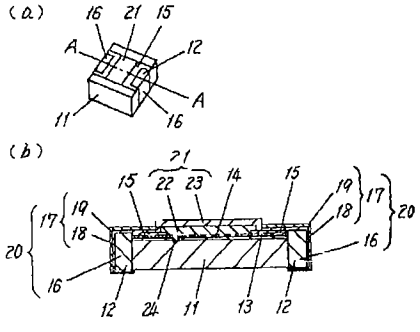
(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地
(72)発明者　橋本　正人
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(72)発明者　福岡　章夫
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(74)代理人　100097445
弁理士　岩橋　文雄　（外２名）

最終頁に続く

(54)【発明の名称】　抵抗器およびその製造方法

(57)【要約】
【課題】　基板の切断コストを抑えることができる抵抗器およびその製造方法を提供することを目的とする。
【解決手段】　基板１１と、前記基板１１の上面に設けられた抵抗層１４と、前記抵抗層１４の上面の両端部に設けられた一対の上面電極層１５とを有し、前記基板１１は樹脂系の材料からなることを特徴とするものである。

11 基　板
12 切り欠き部
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
17 めっき層
20 外部電極層
21 保護膜
22 第1の保護層
23 第2の保護層



【特許請求の範囲】

【請求項１】　基板と、前記基板の上面に設けられた抵抗層と、前記抵抗層の上面の両端部に設けられた一対の上面電極層とを有し、前記基板は樹脂系の材料からなることを特徴とする抵抗器。

【請求項２】　抵抗層を基板の上面に設けられた酸化物からなる下地層の上面に形成したことを特徴とする請求項１記載の抵抗器。

【請求項３】　基板が液晶ポリマーからなることを特徴とする請求項１記載の抵抗器。

【請求項４】　一対の上面電極層と電気的に接続されるように前記基板の端面に設けられた一対の端面電極層および前記端面電極層の表面に形成されためっき層からなる外部電極層を、前記基板の両端部に設けられた一対の切り欠き部に形成したことを特徴とする請求項１記載の抵抗器。

【請求項５】　端面電極層を金属粉末と樹脂とからなる材料で構成したことを特徴とする請求項４記載の抵抗器。

【請求項６】　外部電極層の上面を保護膜の上面の上方に設けたことを特徴とする請求項４記載の抵抗器。

【請求項７】　外部電極層を基板の裏面に設けないようにしたことを特徴とする請求項４記載の抵抗器。

【請求項８】　外部電極層を上面電極層の上面に設けたことを特徴とする請求項４記載の抵抗器。

【請求項９】　少なくとも抵抗層を覆うように設けられた保護膜が酸化物からなる第１の保護層と、前記第１の保護層の上面に形成された樹脂からなる第２の保護層とで構成されたことを特徴とする請求項１記載の抵抗器。

【請求項１０】　基板と、前記基板の上面に設けられた複数の抵抗層と、前記複数の抵抗層のそれぞれの上面の両端部に設けられた複数対の上面電極層と、前記複数対の上面電極層と電気的に接続されるように前記基板の端面に設けられた複数対の端面電極層および前記端面電極層の表面に形成されためっき層からなる複数の外部電極層と、前記基板は樹脂系の材料からなり、前記基板の端面における前記外部電極層間に位置する部分に凹部が形成されたことを特徴とする抵抗器。

【請求項１１】　樹脂系の材料からなる基板に酸化物からなる下地層を設ける工程と、前記下地層の上面に抵抗層を設ける工程と、前記抵抗層の上面の両端部に一対の上面電極層を設ける工程と、前記一対の上面電極層と電気的に接続されるように、前記基板の端面に形成される一対の端面電極層を設ける工程と、前記一対の端面電極層の表面にめっき層を設けて外部電極層を形成する工程と、少なくとも前記抵抗層を覆うように保護膜を設ける工程とを備えたことを特徴とする抵抗器の製造方法。

【請求項１２】　端面電極層を金属粉末と樹脂とからなる混合ペーストを硬化させることにより形成するようにしたことを特徴とする請求項１１記載の抵抗器の製造方法。

【請求項１３】　上面電極層および抵抗層をスパッタにより形成した後に、それぞれフォトリソ工法により所定形状にパターンニングすることを特徴とする請求項１１記載の抵抗器の製造方法。

【請求項１４】　下地層および保護膜はスパッタにより形成されたことを特徴とする請求項１１記載の抵抗器の製造方法。

【請求項１５】　樹脂系の材料からなる基板に下地層を設ける工程と、前記下地層の上面に複数の抵抗層を設ける工程と、前記複数の抵抗層の上面の両端部に複数対の上面電極層を設ける工程と、前記複数対の上面電極層と電気的に接続されるように、前記基板の端面に形成される複数対の端面電極層、および前記端面電極層の表面にめっき層を設けて外部電極層を形成する工程と、少なくとも前記複数の抵抗層を覆うように保護膜を設ける工程とを備え、前記基板の端面における前記外部電極層間に位置する部分に凹部を形成することを特徴とする抵抗器の製造方法。

【請求項１６】　少なくとも保護膜を設けた後、１個の抵抗器に相当する領域が連続して区画されるように分割用の縦溝と横溝とを基板に設け、前記分割用の縦溝と横溝に沿って前記基板を分割し、複数の抵抗器を得るようにしたことを特徴とする請求項１１または１５記載の抵抗器の製造方法。

【請求項１７】　分割用の縦溝と横溝をレーザーにより形成することを特徴とする請求項１６記載の抵抗器の製造方法。

【請求項１８】　基板の縦溝となる部分を跨がり、かつ横溝を跨がらないように貫通孔を設け、前記貫通孔に導電体を充填させるとともに前記導電体を上面電極層と電気的に接続させて端面電極層を設けるようにしたことを特徴とする請求項１６記載の抵抗器の製造方法。

【請求項１９】　基板の縦溝となる部分を跨がり、かつ横溝を跨がらないように貫通孔を設け、前記貫通孔に端面電極層をスパッタにより形成したことを特徴とする請求項１６記載の抵抗器の製造方法。

【請求項２０】　分割用の縦溝あるいは横溝に、端面電極層をスパッタにより形成したことを特徴とする請求項１６記載の抵抗器の製造方法。

【請求項２１】　基板にシート固定材を貼り付けた後、分割用の縦溝と横溝とを基板に設け、その後、基板から前記シート固定材を分離させるようにして基板を分割することを特徴とする請求項１６記載の抵抗器の製造方法。

【請求項２２】　シート固定材として紫外線硬化特性を有する接着剤を含むものを用いたことを特徴とする請求項２１記載の抵抗器の製造方法。

【請求項２３】　基板からシート固定材を分離させる工程は紫外線を照射することにより行うことを特徴とする

請求項２２記載の抵抗器の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、各種電子機器に使用される抵抗器、あるいは微細にパターン形成された多連チップ抵抗器およびその製造方法に関するものである。

【０００２】

【従来の技術】近年、電子機器の小形化に伴い、プリント基板への実装密度を上げるために、電子機器に使用される抵抗器などの電子部品に対して、小形化や複数の独立素子が１つのユニットになっている多連化の要求が高まってきている。

【０００３】従来の抵抗器として、実開平４－３８００１号のマイクロフィルタに記載されたものが知られている。

【０００４】なお、ここでは抵抗器として、抵抗器のうちの１つである複数の独立した抵抗層が１つのユニットになっている多連チップ抵抗器について述べる。

【０００５】以下、従来の抵抗器およびその製造方法について、図面を参照しながら説明する。

【０００６】図１８（ａ）は従来の抵抗器の斜視図、図１８（ｂ）は同Ｅ－Ｅ線断面図である。

【０００７】図１８において、１はアルミナからなる絶縁基板である。２は絶縁基板１の上面の両端部に設けられた二対の上面電極層である。３は二対の上面電極層２に一部が重なるように設けられた２つの抵抗層である。このとき２つの抵抗層３は独立している。４は２つの抵抗層３の全体を覆うように設けられた保護層である。５ａは絶縁基板１の側面に設けられた二対の側面電極層である。５ｂは二対の上面電極層２および二対の側面電極層５ａの表面に設けられたニッケルとはんだめっきからなるめっき層である。

【０００８】以上のように構成された従来の抵抗器について、以下にその製造方法を図面を参照しながら説明する。

【０００９】図１９、図２０は従来の抵抗器の製造方法を示す工程図である。

【００１０】まず、図１９（ａ）に従来の抵抗器を製造する場合のシート状の絶縁基板８ａを示す。この絶縁基板８ａにはスルーホール９および縦方向の分割溝１０ａおよび横方向の分割溝１０ｂが形成されている。

【００１１】次に、図１９（ｂ）に示すように、シート状の絶縁基板８ａの上面に、複数対の上面電極層２を印刷形成し、更にそれぞれの対の上面電極層２の一部に重なるように複数の抵抗層３を印刷形成する。

【００１２】次に、図２０（ａ）に示すように、複数の抵抗層３の全体を覆うように複数の保護層４を印刷形成した後、横方向の分割溝１０ｂ（図１８に図示）に沿って分割し、短冊状の絶縁基板８ｂに分割する。

【００１３】次に、図２０（ｂ）に示すように、短冊状の絶縁基板８ｂの側面部に側面電極層５ａを塗着形成する。

【００１４】その後、短冊状の絶縁基板８ｂを縦方向の分割溝１０ａに沿って分割し、個片状の絶縁基板（図示せず）を得る。

【００１５】最後に、図１８（ａ）に示すように上面電極層２および側面電極層５ａの表面にニッケルめっきを施した後、はんだめっきを施すことにより、めっき層５ｂを形成し、従来の抵抗器を製造していた。

【００１６】また、前記抵抗器も非常に小形化されてきており、近年では長さ０．６ｍｍ×幅０．８ｍｍ×厚み０．３５ｍｍに２素子を内蔵した非常に小形な多連形の抵抗器も製造されるようになってきた。

【００１７】

【発明が解決しようとする課題】上記従来の抵抗器は、基板１としてアルミナなどの磁器を焼成したものを用いているため、基板の組成バラツキや焼成時の温度バラツキによって、基板に寸法バラツキが生じていた（この寸法バラツキは、約１００ｍｍ×約１００ｍｍの基板では約０．５ｍｍ程度に達する）。

【００１８】この寸法バラツキをもつ基板を用いて、抵抗器を製造する場合は、スクリーン印刷に使用するマスクを多数用意し、基板の寸法バラツキに応じてマスクを交換する必要が生じて、非常に工程が煩雑になっていた。

【００１９】すなわち、寸法バラツキをもつ基板に対して上面電極層２、抵抗層３、保護層４などを形成するためのスクリーン印刷に使用するマスクが少しでもずれると形成位置がずれて不良となってしまうため、寸法バラツキをもつ基板を細かい寸法ランクに分類し、それぞれの寸法ランクに相当する上面電極層２、抵抗層３、保護層４などのスクリーン印刷に使用するマスクが必要となるからである（寸法ランクを縦方向、横方向それぞれ０．０５ｍｍ刻みで分類する場合は約６００ランク以上の寸法分類が必要であった）。また、特に多連チップ抵抗器は、１つのユニットに複数の独立した抵抗層をもつため、上面電極層、抵抗層、保護層が非常に微細なパターン形状となり、このことは非常に大きな問題となる。

【００２０】さらに、上記した工程の煩雑さを解消するために、上面電極層、抵抗層、保護層などのスクリーン印刷後に基板を切断すれば、基板を寸法ランクに分類する必要が無くなるが、この切断を半導体のシリコンウエハーを切断するように、ダイアモンドを含有する刃を用いて行えば、半導体のシリコンウエハーよりアルミナが硬いため、分割するための刃の摩耗が非常に早く、この結果、この方法においては切断コストが多大になるという課題を有していた。

【００２１】本発明は、上記従来の課題を解決するもので、基板の切断コストを抑えることができる抵抗器およ

びその製造方法を提供することを目的とする。

【0022】

【課題を解決するための手段】上記目的を達成するために本発明の抵抗器は、基板と、前記基板の上面に設けられた抵抗層と、前記抵抗層の上面の両端部に設けられた一対の上面電極層とを有し、前記基板は樹脂系の材料からなることを特徴とするもので、この構成によれば、基板の切断コストを抑えることができるという効果が得られる。

【0023】

【発明の実施の形態】本発明の請求項1に記載の発明は、基板と、前記基板の上面に設けられた抵抗層と、前記抵抗層の上面の両端部に設けられた一対の上面電極層とを有し、前記基板は樹脂系の材料からなることを特徴とするもので、この構成によれば、アルミナより柔らかい樹脂系の材料からなる基板を用いたため、基板切断用の刃の摩耗を抑えることができ、これにより、基板の切断コストを抑えることができるという作用を有するものである。

【0024】請求項2に記載の発明は、抵抗層を基板の上面に設けられた酸化物からなる下地層の上面に形成したことを特徴とするもので、この構成によれば、一般的に吸湿性のある樹脂系の材料からなる基板上面に酸化物からなる下地層を形成したため、酸化物からなる下地層によって水分の基板への侵入を減少させることができ、これにより、基板の耐湿性が向上するという作用を有するものである。

【0025】請求項3に記載の発明は、基板が液晶ポリマーからなることを特徴とするもので、この構成によれば、基板の熱膨張係数が容易に選択できるため、抵抗層やプリント基板の熱膨張係数との関係を調整でき、これにより、熱膨張係数の違いによる使用時における基板の反りなどを防止できるという作用を有するものである。

【0026】請求項4に記載の発明は、一対の上面電極層と電気的に接続されるように前記基板の端面に設けられた一対の端面電極層および前記端面電極層の表面に形成されためっき層からなる外部電極層を、基板の両端部に設けられた一対の切り欠き部に形成したことを特徴とするもので、この構成によれば、切り欠き部のない基板に端面電極層を設けたものよりも、端面電極層が基板から突出しない分だけ端面電極層を含めた抵抗器を小形化にできるという作用を有するものである。

【0027】請求項5に記載の発明は、端面電極層を金属粉末と樹脂からなる材料で構成したことを特徴とするもので、この構成によれば、端面電極層を130℃～240℃という低温で焼成できるため、抵抗層への熱の影響を抑えることができ、これにより、生産中における抵抗値の変化を小さくできるという作用を有するものである。

【0028】請求項6に記載の発明は、外部電極層の上面を保護膜の上面より上方に設けたことを特徴とするもので、この構成によれば、基板の上面側をプリント基板側に向けても外部電極の上面がプリント基板に接触するため、基板の上下面のどちらをプリント基板側に向けても実装可能になるという作用を有するものである。

【0029】請求項7に記載の発明は、外部電極層を基板の裏面に設けないようにしたことを特徴とするもので、この構成によれば、基板の裏面を自動実装機の吸着ピンで吸着し、基板の上面側をプリント基板側に向けてプリント基板に実装する場合、吸着時の安定性が向上するため、高い実装率を確保できるという作用を有するものである。

【0030】請求項8に記載の発明は、外部電極層を上面電極層の上面に設けたことを特徴とするもので、この構成によれば、外部電極層と上面電極層との接触面積が大きくなるため、熱衝撃などの環境負荷を受けてもこの間の接触抵抗の増加を抑えることができ、これにより、抵抗層が低抵抗値でも抵抗層の抵抗値に対する接触抵抗の増加分の割合を小さくできるため、抵抗値変化率を低くできるという作用を有するものである。

【0031】請求項9に記載の発明は、少なくとも抵抗層を覆うように設けられた保護膜が酸化物からなる第1の保護層と、前記第1の保護層の上面に形成された樹脂からなる第2の保護層とで構成されたことを特徴とするもので、この構成によれば、耐熱性の優れた酸化物からなる第1の保護層と、耐湿性に優れた樹脂からなる第2の保護層とで抵抗層が覆われるため、抵抗層が熱や水分の影響を受けず、これにより、使用時の抵抗値変化率を小さくできるという作用を有するものである。

【0032】請求項10に記載の発明は、基板と、前記基板の上面に設けられた複数の抵抗層と、前記複数の抵抗層のそれぞれの一面の両端部に設けられた複数対の上面電極層と、前記各対の上面電極層と電気的に接続されるように前記基板の端面に設けられた複数対の端面電極層および前記各端面電極層の表面に形成されためっき層からなる複数の外部電極層と、少なくとも前記複数の抵抗層を覆うように設けられた保護膜とを有し、前記基板は樹脂系の材料からなり、前記基板の端面における前記外部電極層間に位置する部分に凹部が形成されたことを特徴とするもので、この構成によれば、アルミナより柔らかい樹脂系の材料からなる基板を用いたため、基板切断用の刃の摩耗を抑えることができ、これにより、基板の切断コストを抑えることができることに加え、複数の独立した抵抗層を有する多連チップ抵抗器において、各抵抗層に対応する各外部電極層間は凹部によって基板の端面における距離が離れているため、外部電極層の形成時に外部電極層同士が接触して抵抗層同士が電気的に接続してしまうことを防止できるという作用を有するものである。

【0033】請求項11に記載の発明は、樹脂系の材料

からなる基板に酸化物からなる下地層を設ける工程と、前記下地層の上面に抵抗層を設ける工程と、前記抵抗層の上面の両端部に一対の上面電極層を設ける工程と、前記一対の上面電極層と電気的に接続されるように、前記基板の端面に形成される一対の端面電極層を設ける工程と、前記一対の端面電極層の表面にめっき層を設けて外部電極層を形成する工程と、少なくとも前記抵抗層を覆うように保護膜を設ける工程とを備えたことを特徴とするもので、この製造方法によれば、アルミナより柔らかい樹脂系の材料からなる基板を用いたため、基板切断時における基板切断用の刃の摩耗を抑えることができ、これにより、基板の切断コストを抑えることができるという作用を有するものである。

【００３４】請求項１２に記載の発明は、端面電極層を金属粉末と樹脂とからなる混合ペーストを硬化させることにより形成するようにしたことを特徴とするもので、この製造方法によれば、端面電極層１３０℃～２４０℃という低温で焼成できるため、抵抗層への熱の影響を抑えることができ、これにより、生産中における抵抗値の変化を小さくできるという作用を有するものである。

【００３５】請求項１３に記載の発明は、上面電極層および抵抗層をスパッタにより形成した後に、それぞれフォトリソ工法により所定形状にパターンニングすることを特徴とするもので、この製造方法によれば、上面電極層および抵抗層を薄く形成できるため、分割用の縦溝あるいは横溝で基板を分割し易くなることに加え、フォトリソ工程により抵抗層が高精度にパターン形成されるため、抵抗層の有効面積を大きくすることができ、これにより、高電力が印加されても抵抗値変化率を低くできるという作用を有するものである。

【００３６】請求項１４に記載の発明は、下地層および保護膜はスパッタにより形成されたことを特徴とするもので、この製造方法によれば、下地層および保護膜を緻密に形成できるため、抵抗層へ湿気が入り込みにくくなり、これにより、抵抗層が安定するという作用を有するものである。

【００３７】請求項１５に記載の発明は、樹脂系の材料からなる基板に下地層を設ける工程と、前記下地層の上面に複数の抵抗層を設ける工程と、前記複数の抵抗層の上面の両端部に複数対の上面電極層を設ける工程と、前記複数対の上面電極層と電気的に接続されるように、前記基板の端面に形成される複数対の端面電極層、および前記端面電極層の表面にめっき層を設けて外部電極層を形成する工程と、少なくとも前記複数の抵抗層を覆うように保護膜を設ける工程とを備え、前記基板の端面における前記外部電極層間に位置する部分に凹部を形成することを特徴とするもので、この製造方法によれば、アルミナより柔らかい樹脂系の材料からなる基板を用いるため、基板切断用の刃の摩耗を抑えることができ、これにより、基板の切断コストを抑えることができることに加え、複数の独立した抵抗器を有する多連チップ抵抗器において、各抵抗器を区画する各外部電極層間は凹部によって基板の端面上の外部電極層間が離れるため、外部電極層の形成時に外部電極層同士が接触して抵抗層同士が電気的に接続してしまうことを防止できるという作用を有するものである。

【００３８】請求項１６に記載の発明は、少なくとも保護膜を設けた後、１個の抵抗器に相当する領域が連続して区画されるように分割用の縦溝と横溝とを基板に設け、前記分割用の縦溝と横溝に沿って前記基板を分割し、複数の抵抗器を得るようにしたことを特徴とするもので、この製造方法によれば、上面電極層、抵抗層、端面電極層、保護膜などの形成後に基板を分割するため、基板を寸法ランクに分割する必要が無くなり、これにより、工程の煩雑さを軽減することに加え、基板を端面電極層などを形成するために一時短冊状に分割する必要はなくなり、これにより、一回分割するだけで複数の抵抗器を得ることができる結果、工程が簡略化できるという作用を有するものである。

【００３９】請求項１７に記載の発明は、分割用の縦溝と横溝をレーザーにより形成することを特徴とするもので、この製造方法によれば、レーザーの照射された部分だけ確実かつ高精度に分割用の縦溝と横溝を形成できるため、生産性が向上するという作用を有するものである。

【００４０】請求項１８に記載の発明は、基板の縦溝となる部分を跨がり横溝を跨がらないように貫通孔を設け、前記貫通孔に導電体を充填させるとともに前記導電体を上面電極層に電気的に接続させて端面電極層を設けるようにしたことを特徴とするもので、この製造方法によれば、縦溝と横溝とで囲まれた１個の抵抗器に相当する領域内に端面電極層を形成できるため、基板を個片状に分割した後に端面電極層を設けたものよりも、端面電極層が基板から突出しない分だけ端面電極層を含めた抵抗器を小形化できるという作用を有するものである。

【００４１】請求項１９に記載の発明は、基板の縦溝となる部分を跨がり横溝を跨がらないように貫通孔を設け、前記貫通孔に導電層をスパッタにより形成したことを特徴とするもので、この製造方法によれば、縦溝と横溝に囲まれた１個の抵抗器に相当する領域内に端面電極層を形成するために基板を個片状に分割した後に端面電極層を設けたものよりも、端面電極層が基板から突出しない分だけ端面電極層を含めた抵抗器を小形化にできることに加え、さらに薄く端面電極を形成できるため、貫通孔内に確実に端面電極層が入り込み、これにより、安定した端面電極層を設けることができるという作用を有するものである。

【００４２】請求項２０に記載の発明は、分割用の縦溝あるいは横溝に導電層をスパッタにより形成したことを特徴とするもので、この製造方法によれば、非常に薄く端面電極を形成できるため、分割溝内に確実に

端面電極層が入り込み、これにより、安定して端面電極層を設けることができるという作用を有するものである。

【００４３】請求項２１に記載の発明は、基板にシート固定材を貼り付けた後、分割用の縦溝と横溝とを基板に設け、その後、基板から前記シート固定材を分離させるようにして基板を分割することを特徴とするもので、この製造方法によれば、分割用の縦溝と横溝のうち一方を設けたときに位置ずれを起こしてもう一方の分割用の溝を所定の位置に設けることができなかったり、基板を分割した時に、個片状の各抵抗器がばらばらに散らばって、この後の工程が煩雑になることを防止できるという作用を有するものである。

【００４４】請求項２２に記載の発明は、シート固定材として紫外線硬化特性を有する接着剤を含むものを用いたことを特徴とするもので、この製造方法によれば、紫外線を照射することによって高速でシート固定材の接着力を無くすことができるため、生産性が向上することに加え、シート固定材の接着力を根本的に無くすことができるため、基板から確実にシート固定材を分離できるという作用を有するものである。

【００４５】請求項２３に記載の発明は、基板からシート固定材を分離させる工程は紫外線を照射することにより行うことを特徴とするもので、この製造方法によれば、紫外線を照射することによって容易にシート固定材の接着力を無くすことができるため、容易に基板からシート固定材を分離できるという作用を有するものである。

【００４６】（実施の形態１）以下、実施の形態１における抵抗器およびその製造方法について、図面を参照しながら説明する。

【００４７】図１（ａ）は本発明の実施の形態１における抵抗器の斜視図、図１（ｂ）は同Ａ－Ａ線断面図である。なお、図１（ａ）は、後述するめっき層１７を省略している。

【００４８】図１（ａ）（ｂ）において、１１は基板で、両端部に切り欠き部１２を有し、樹脂、樹脂化合物、樹脂混合物などの樹脂系の材料からなる。この切り欠き部１２の形状は、基板１１の上方から見て、略矩形状となっている。もちろん略半円形状などの他の形状であっても構わない。１３は下地層で、基板１１の上面に設けられ、アルミナを主成分とする酸化物からなる。１４は抵抗層で、基板１１上面に下地層１３を介して設けられている。抵抗層１４の材料は、目標とする抵抗値や用途などによって、酸化ルテニウムやニッケルーリンなどから選定すればよい。

【００４９】なお、基板１１として、液晶ポリマーを用いると、熱膨張係数の異なる液晶ポリマーのうち、適当な熱膨張係数のものを容易に選択できるため、抵抗層１４やプリント基板の熱膨張係数との関係を調整でき、これにより、熱膨張[illegible]による使用時における基板１１の反りなど[illegible]という効果が得られる。また、下地層１３[illegible]ミナを主成分とする酸化物は、水分の基板１１へ[illegible]させることができるため、一般的に吸湿性[illegible]リマーなどの樹脂系の材料からなる基板１１の[illegible]性を向上させる効果を得るためである。

【００５０】１５は一対の上面電極層で、抵抗層１４の上面の両端部に設けられ、金属の材料からなる。１６は一対の端面電極[illegible]、上面電極層１５のそれぞれの端面と[illegible]されるように、基板１１の両端部に設けられた[illegible]１２に形成され、導電体からなる。この[illegible]金属粉末と樹脂とからなる材料を用いれば[illegible]を１３０℃～２４０℃という低温で焼成で[illegible]抗層への熱の影響を抑えることができ、[illegible]産中における抵抗値の変化を小さくできる

【００５１】このように端面電極層１６を基板１１の両端部に設けられた[illegible]部１２に形成することによって、切り欠き部[illegible]面電極層を設けたものよりも、端面電極[illegible]から突出しない分だけ端面電極層１６[illegible]を小形化にできるという効果が得られる[illegible]極層１６は切り欠き部１２全体を埋め[illegible]ており、この結果、外部電極層の断面[illegible]くできるため、プリント基板との接合強度を向上[illegible]できる。

【００５２】[illegible]で、端面電極層１６の表面および上面電極[illegible]の一部に設けられ、ニッケルめっき層（バ[illegible]１８と、低融点金属めっき層１９からなる。[illegible]極層１６の表面にはニッケルめっき層１８、[illegible]き層１８の表面には低融点金属めっき層[illegible]いる。２０は外部電極層で、端面電極層[illegible]１７とからなり、基板１１の端面、上面[illegible]面の一部に形成され、基板１１の裏面に[illegible]ない。２１は保護膜で、少なくとも抵抗[illegible]うに設けられ、アルミナ、シリカなど[illegible]ら第１の保護層２２と、フェノール系[illegible]脂からなる第２の保護層２３で構成さ[illegible]と、抵抗層１４の上面には第１の保護層２[illegible]護層２２の上面には第２の保護層２３が形[illegible]る。

【００５３】[illegible]極層２０を基板１１の裏面に設けない[illegible]板１１の裏面を自動実装機の吸着ピン[illegible]１の上面側をプリント基板側に向けて[illegible]する場合、吸着時の安定性が向上す[illegible]を確保できるという効果が得られる[illegible]２１が耐熱性のあるアルミナ、シリカなど[illegible]ら第１の保護層２２と、第１の保護層[illegible]された耐湿性のあるフェノール系あるい[illegible]脂からなる第２の保護層２

3とで構成することによって、耐熱性、耐湿性に優れた保護膜２１で抵抗層１４が覆われるため、抵抗層１４が熱や水分の影響を受けなくて済み、これにより、使用時の抵抗値変化率を小さくできるという効果も得られる。さらに、外部電極層１６を上面電極層１５の上面に設けることによって、外部電極層２０と上面電極層１５との接触面積が大きくなるため、熱衝撃などの環境負荷を受けてもこの間の接触抵抗の増加を抑えることができ、これにより、抵抗層１４が低抵抗値でも抵抗層１４の抵抗値に対する接触抵抗の増加分の割合を小さくできるため、抵抗値変化率を低くできるという効果も得られる。

【００５４】以上のように構成された本発明の実施の形態１における抵抗器について、以下にその製造方法を図面を参照しながら説明する。

【００５５】図２～図８は、本発明の実施の形態１における抵抗器の製造方法を示す図である。なお、各図において、（ｂ）は上面図、（ａ）は（ｂ）のＢ－Ｂ線断面図であり、これと同様に（ｄ）（ｆ）が上面図、（ｃ）（ｅ）はそれぞれ（ｄ）（ｆ）のＢ－Ｂ線断面図である。

【００５６】まず、図２（ａ）（ｂ）に示すように、樹脂、樹脂化合物、樹脂混合物などの樹脂系の材料からなる基板１１を用意する（なお、この基板１１は複数の抵抗器を製造するために、１個の抵抗器より大きなシート状の基板をいう。１個の抵抗器を得るためにはこのシート状の基板を分割する必要がある。）。

【００５７】なお、基板１１の厚みは０．０５ｍｍ～０．２５ｍｍが望ましい。基板１１が０．２５ｍｍ以下と薄いため基板切断時の刃の摩耗を小さく抑えることができる。ただし、０．０５ｍｍ以下になると抵抗層１４などを形成しにくかったり、基板１１自体の取扱いが難しくなる。

【００５８】次に、図２（ｃ）（ｄ）に示すように、基板１１の上面にアルミナなどの酸化物からなる下地層１３を設ける。

【００５９】次に、図２（ｅ）（ｆ）に示すように、下地層１３をフォトリソ工程によりパターンニングする。このとき、１個の抵抗器（１個の独立した抵抗層１４を有する部分）に相当する領域の外周部（後述する分割用の縦溝２８、横溝２９が形成される部分）以外を残すようにする。

【００６０】次に、図３（ａ）（ｂ）に示すように、下地層１３と、下地層１３が上面にない基板１１との上面に、スパッタにより抵抗層１４を設ける。

【００６１】次に、図３（ｃ）（ｄ）に示すように、抵抗層１４上面の全面にスパッタにより金系の材料からなる上面電極層１５を設ける。なお、必要に応じて基板１１の裏面に裏面電極を設けてもよい。

【００６２】次に、図３（ｅ）（ｆ）に示すように、上面電極層１５をフォトリソ工法によりパターンニングする。このとき、１個の抵抗器（１個の独立した抵抗層１４を有する部分）に相当する領域において、抵抗層１４上面の両端部に上面電極層１５が形成されるようにする。さらに１個の抵抗器（１個の独立した抵抗層１４を有する部分）に相当する領域において上面電極層１５が連続しないようにする。

【００６３】次に、図４（ａ）（ｂ）に示すように、目標とする抵抗値に応じてフォトリソ工程やレーザーなどにより抵抗層１４をパターンニングする。さらに、抵抗器（１個の独立した抵抗層１４を有する部分）に相当する領域の外周部以外に残っている下地層１３のみに形成されるようにする。このとき、下地層１３および抵抗層１４の上面に形成された上面電極層１５が後工程で設ける分割用の縦溝２８に跨がり、横溝２９に跨がらないようにする。

【００６４】次に、上面電極層１５および抵抗層１４をスパッタにより形成した後に、それぞれフォトリソ工法により所定形状にパターンニングするようにしたことによって、上面電極層１５および抵抗層１４を薄く形成できるため、縦溝２８あるいは横溝２９で基板１１を分割する際に加え、フォトリソ工程により抵抗層１４がパターン形成されるため、抵抗層１４の有効面積を大きくすることができ、これにより、高電力が得られ抵抗値変化率を低くできるという効果が得られる。

【００６５】次に、図４（ｃ）（ｄ）に示すように、１個の抵抗器（１個の独立した抵抗層１４を有する部分）に相当する領域において上面電極層１５間の抵抗値を調整するためにレーザートリミングによりトリミング溝２７を設ける。

【００６６】次に、図４（ｅ）（ｆ）に示すように、少なくとも抵抗層１４が露出するように、上面電極層１５の一部の上面にエポキシ樹脂をスクリーン印刷により設ける。この後、樹脂が安定するように１５０℃、１０分の温度でキュアする。

【００６７】次に、図５（ａ）（ｂ）に示すように、露出した抵抗層１４、上面電極層１５の一部、レジスト層２５の上面にスパッタにより、アルミナなどの酸化物からなる第１の保護層２２を設ける。

【００６８】次に、図５（ｃ）（ｄ）に示すように、レジスト層２５をリフトオフし第１の保護層２２をパターンニングする。

【００６９】このとき、下地層１３および保護膜２１のうち少なくとも第１の保護層２２をスパッタにより形成することにより、下地層１３および保護膜２１を緻密に形成できるため、抵抗層１４へ湿気が入り込みにくくなり、これにより、抵抗層が安定するという効果が得られる。

【００７０】次に、図５（ｅ）（ｆ）に示すように、第

1の保護層22の上面に樹脂からなる第2の保護層23をスクリーン印刷により設ける。この後第2の保護層23が安定するように180℃、30分の温度で硬化する。このとき、第1の保護層22および第2の保護層23からなる保護膜21が、少なくとも抵抗層14を覆うようにする。

【0071】このように、第2の保護層23をスクリーン印刷により設けることによって、第2の保護層23を安価に形成できる。

【0072】次に、図6（a）（b）に示すように、1個の抵抗器（1個の独立した抵抗層14を有する部分）に相当する領域における基板11の両端部に貫通孔26を設ける。すなわち、貫通孔26が後工程で設ける分割用の縦溝28に跨がり、かつ横溝29に跨がらないようにすればよい。なお、この貫通孔26が図1における切り欠き部12に相当する。

【0073】次に、図6（c）（d）に示すように、貫通孔26に金属粉末と樹脂とからなる混合ペーストを充填して端面電極層16を設ける。この後端面電極層の16が安定するように200℃、30分の温度で硬化する。このとき、端面電極層16は、抵抗層14、上面電極層15のそれぞれの端面と電気的に接続されるように基板11の両端面に設ける。

【0074】このように、基板11の縦溝28となる部分を跨がり、かつ横溝29を跨がらないように貫通孔26を設け、貫通孔26に導電体を充填させるとともに上面電極層15と電気的に接続させて端面電極層16を設けるようにしたことによって、縦溝28と横溝29に囲まれた1個の抵抗器に相当する領域内に端面電極層16を形成できるため、基板11を個片状に分割した後に端面電極層16を設けたものよりも、端面電極層16が基板11から突出しない分だけ端面電極層16を含めた抵抗器を小形化できる。

【0075】さらに、端面電極層16を貫通孔26に金属粉末と樹脂とからなる混合ペーストを硬化させることにより形成したため、端面電極層16を130℃～240℃という低温で焼成でき、これにより、抵抗層14への熱の影響を抑えることができ、生産中における抵抗値の変化を小さくできるという効果が得られる。

【0076】また、上記したように貫通孔26に金属粉末と樹脂とからなる導電体を充填する代わりに、スパッタによって端面電極層16を設けてもよい。このとき、上記した効果に加え、貫通孔26が小さくても、端面電極層16を非常に薄く形成できるため、貫通孔26内に確実に端面電極層16が入り込み、これにより、安定して端面電極層16を設けることができるという効果も期待できる。

【0077】次に、図6（e）（f）に示すように、紫外線硬化特性を有する接着剤が片面に設けられたシート固定材27を、基板11下面の全面に、接着剤が基板11に接触するようにして貼り付けた後、分割用の縦溝28を設ける。この後、抵抗層14、上面電極層15、端面電極層16の表面に保護膜21を設けるようにする。

【0078】次に、図6（e）（b）に示すように、分割用の横溝29を設ける。このとき、抵抗層14、上面電極層15、端面電極層16が横溝29に跨がらないようにする。

【0079】もちろん、抵抗層14、上面電極層15などの構成要素の表面に形成するもの（この場合保護膜21）を設ける前に、分割用の縦溝28、横溝29を形成して基板11を分割する方が、基板11を分割してから1個ずつの抵抗器に保護膜を設けるより効率的である。

【0080】この縦溝28、横溝29は、ダイシング工程や、YAGレーザーを照射することによって設ける。なお、YAGレーザーを用いれば、レーザーの照射されたところを、かつ高速に分割用の縦溝28と横溝29を形成できるため、生産性が向上する。

【0081】また、分割用の縦溝28と横溝29は、基板11とシート固定材27の一部に形成される。もちろん、分割用の縦溝28と横溝29を基板11の途中まで形成し、その後、ブレーク工法などによって基板11を分割して複数の抵抗器を得るようにしてもよい。

【0082】なお、上記したように貫通孔26に金属粉末と樹脂とからなる導電体を充填したり、スパッタすることによって端面電極層16を設ける代わりに、貫通孔26を形成せずに、分割用の縦溝28、横溝29にスパッタによって端面電極層16を設けてもよい。このとき、非常に薄い端面電極層16を形成できるため、分割溝内に確実に端面電極層16が入り込み、これにより、安定して端面電極層16を設けることができる。

【0083】次に、図6（c）（d）に示すように、紫外線を照射してシート固定材27を基板11から分離させ、基板11を縦溝28と横溝29に沿って分割して複数の個片状の抵抗器に分割する。

【0084】このように基板11にシート固定材27を貼り付けた後、分割用の縦溝28と横溝29とを基板11に設け、その後、基板11からシート固定材27を分離させて基板11を分割するようにしたことによって、分割用の縦溝28、横溝29のうち一方を設けたときに位置ずれを生じても、一方の分割用の溝を所定の位置に設けることができたり、基板11を分割した時に、個片状の抵抗器がばらばらに散らばって、この後の工程が容易に行なえるという効果が得られる。また、シート固定材27として紫外線硬化特性を有する接着剤を用いたため、紫外線を照射することによってシート固定材27の接着力を無くすことができ、生産性が向上することに加え、シート固定材27の接着力を根本的に無くすことができるため、確実にシート固定材27

を分離できる。さらに、基板１１からシート固定材２７を分離させる工程は紫外線を照射することにより行うため、紫外線を照射することによって容易にシート固定材２７の接着力を無くすことができ、これにより、容易に基板１１からシート固定材２７を分離できる。

【００８５】最後に、図８（ａ）（ｂ）に示すように、端面電極層１６の表面および露出している上面電極層１５の上面に、ニッケルめっき層１８と低融点金属めっき層１９からなるめっき層１７を設ける。

【００８６】上記した本発明の実施の形態１における抵抗器は、アルミナより柔らかい樹脂系の材料からなる基板１１を用いたため、基板切断用の刃の摩耗を抑えることができ、これにより、基板の切断コストを抑えることができるという効果が得られる。

【００８７】また、上面電極層１５、抵抗層１４、端面電極層１６、保護膜２１などの形成後に基板１１を分割するため、基板１１を寸法ランクに分類する必要が無くなり、これにより、工程の煩雑さが解消するという効果も得られる。

【００８８】さらに、上面電極層１５、抵抗層１４、端面電極層１６、保護膜２１などの形成後に基板１１を分割するため、端面電極層１６などを形成するために基板１１を一度短冊状に分割する必要はなく、これにより、一回分割するだけで複数の個片状の抵抗器を得ることができ、これにより、工程が簡略化できるという効果も得られる。

【００８９】なお、図７、図８においては、横溝２９によって独立した個片状の抵抗器（１個の独立した抵抗層１４を有する部分）が２個連なったものが複数得られるようになっているが、図１に示したように、横溝２９によって１個の独立した抵抗層１４を有する抵抗器が複数得られるようにしてもよい。もちろん、上記した効果は、１個の独立した抵抗層を有する抵抗器や、後述する実施の形態２における抵抗器のような１個の独立した抵抗層を有する抵抗器が２個以上連なったもの（複数の独立した抵抗層が１つのユニットになっている多連チップ抵抗器）のいずれにもいえる。

【００９０】（実施の形態２）以下、実施の形態２における抵抗器およびその製造方法について、図面を参照しながら説明する。

【００９１】図９（ａ）は本発明の実施の形態２における抵抗器の斜視図、図９（ｂ）は同Ｃ－Ｃ線断面図である。なお、図９（ａ）は、後述する保護膜２１を省略している。また、本発明の実施の形態２における抵抗器は、抵抗器の１種である複数の独立した抵抗層が１つのユニットになっている多連チップ抵抗器である。

【００９２】図９（ａ）（ｂ）において、１１は基板で、両端部に凹部３０を有し、樹脂、樹脂化合物、樹脂混合物などの樹脂系の材料からなる。この凹部３０の形状は、基板１１の上方から見て、略略半円形状となっている。もちろん、[illegible]他の形状であっても構わない。１３は[illegible]の上面に設けられ、アルミナを主成分[illegible]からなる。１４は複数の抵抗層で、基板１[illegible]１３を介して設けられている。抵抗層１[illegible]とする抵抗値や用途などによって、酸[illegible]ケルーリンなどから選定すればよい。[illegible]層１４はそれぞれ独立し、かつ互いに[illegible]されている。

【００９３】[illegible]として、液晶ポリマーを用いると、熱[illegible]樹脂ポリマーのうち、適当な熱膨張係[illegible]選択できるため、抵抗層１４やプリント[illegible]も[illegible]で関係を調整でき、これにより、[illegible]による使用時における基板１１の反り[illegible]という効果が得られる。また、下地層[illegible]主成分とする酸[illegible]は、水分の基板１１へ[illegible]止することができるため、一般的に吸湿[illegible]ーなどの樹脂系の材料からなる基[illegible]させる効果を得るためである。

【００９４】[illegible]面電極層で、各抵抗層１４の上面の[illegible]系の材料からなる。１６は複数対[illegible]の端面電極層１６とそれぞれ対応[illegible]、一対の上面電極層１５の各端面[illegible]るように形成され、導電体からなる[illegible]樹脂からなる材料を[illegible]１３０℃～[illegible]５０℃という低温で硬化[illegible]基板への熱の影響を抑えることができ、[illegible]における抵抗値の変化を小さく[illegible]

【００９５】[illegible]で、各端面電極層１６の表面および[illegible]６に対応する各上面電極層１５の[illegible]、ニッケルめっき層（バリア層[illegible]）[illegible]めっき層１９からなる。また、[illegible]面にはニッケルめっき層１８、[illegible]の表面には低融点金属めっき層１９が[illegible]には複数の外部電極層で、各外部電[illegible]層１５とめっき層１７とからなり、[illegible]面電極層１５の上面の一部に形成[illegible]には設けられていない。また、[illegible]基板１１の凹部における各外部電[illegible]分に形成されている。２１は[illegible]すべての抵抗層１４を覆うように設[illegible]シカなどの酸[illegible]物からなる第１[illegible]ールなるいはエポキシ樹脂から[illegible]で構成されている。また、各抵抗[illegible]の保護層２１と第１の保護層２１[illegible]２[illegible]形成されている。また、[illegible]は保護膜２１の上面より上方に[illegible]ない。

【００９６】[illegible]を基板１１の裏

面に設けないことによって、基板１１の裏面を自動実装機の吸着ピンで吸着し、基板１１の上面側をプリント基板側に向けてプリント基板に実装する場合、吸着時の安定性が向上するため、高い実装率を確保できるという効果が得られる。また、保護膜２１が耐熱性のあるアルミナ、シリカなどの酸化物からなる第１の保護層２２と、第１の保護層２２の上面に形成された耐湿性のあるフェノール系あるいはエポキシ樹脂からなる第２の保護層２３とで構成することによって、耐熱性、耐湿性に優れた保護膜２１で抵抗層１４が覆われるため、抵抗層１４が熱や水分の影響を受けなくて済み、これにより、使用時の抵抗値変化率を小さくできるという効果も得られる。さらに、外部電極層１６を上面電極層１５の上面に設けることによって、外部電極層２０と上面電極層１５との接触面積が大きくなるため、熱衝撃などの環境負荷を受けてもこの間の接触抵抗の増加を抑えることができ、これにより、抵抗層１４が低抵抗値でも抵抗層１４の抵抗値に対する接触抵抗の増加分の割合を小さくできるため、抵抗値変化率を低くできるという効果も得られる。

【００９７】また、基板１１の端面における各外部電極層２０間に位置する部分に凹部３０が形成されたため、この本発明の実施の形態２における抵抗器のような複数の独立した抵抗層が１つのユニットになっている多連チップ抵抗器において、各抵抗層１４に対応する各外部電極層２０間は凹部３０によって（沿面距離ではなく）基板１１の端面における距離が離れ、これにより、外部電極層２０の形成時に外部電極層２０同士が接触して抵抗層１４同士が電気的に接続してしまうことを防止できるという効果が得られる。

【００９８】さらに、外部電極層２０の上面を保護膜２１の上面より上方に設けたため、基板１１の上面側をプリント基板側に向けても外部電極２０の上面がプリント基板に接触するため、基板の上下面のどちらをプリント基板側に向けても実装可能になるという効果も得られる。

【００９９】以上のように構成された本発明の実施の形態２における抵抗器について、以下にその製造方法を図面を参照しながら説明する。

【０１００】図１０～図１６は、本発明の実施の形態２における抵抗器の製造方法を示す図である。なお、各図において、（ｂ）は上面図、（ａ）は（ｂ）のＤ－Ｄ線断面図であり、これと同様に（ｄ）（ｆ）が上面図、（ｃ）（ｅ）はそれぞれ（ｄ）（ｆ）のＤ－Ｄ線断面図である。

【０１０１】まず、図１０（ａ）（ｂ）に示すように、樹脂、樹脂化合物、樹脂混合物などの樹脂系の材料からなる基板１１を用意する（なお、この基板１１は複数の抵抗器を製造するために、１個の抵抗器より大きなシート状の基板をいう。１個の抵抗器を得るためにはこのシート状の基板を分割する必要がある。）。

【０１０２】次に、図１０（ｃ）（ｄ）に示すように、基板１１の上面にアクリルエポキシの感光物からなる下地層１３を設ける。

【０１０３】次に、図１０（ｅ）（ｆ）に示すように、下地層１３をフォトリソ工程によりパターニングする。このとき、[illegible]１個の独立した抵抗層１４を有する[illegible]領域の外周部（後述する分割用の溝[illegible]成される部分）上を残すようにする。

【０１０４】次に、[illegible]（ｂ）に示すように、下地層１３と、[illegible]面にある端板１１との上面に、スパッタにより抵抗層１４を設ける。

【０１０５】次に、[illegible]（ｂ）に示すように、抵抗層１４上面にスパッタにより金系の材料からなる上面電極層[illegible]なお、必要に応じて基板１１の裏面にも[illegible]もよい。

【０１０６】次に、[illegible]（ｂ）に示すように、上面電極層[illegible]法によりパターニングする。このとき、[illegible]器（１個の独立した抵抗層１４を有する[illegible]領域において、抵抗層１４上面[illegible]１５が形成されないようにする。なお、この独立した抵抗層１４を有する部分）に相当する領域において上面電極層１５が連続しないようにする。

【０１０７】次に、図１２（ａ）（ｂ）に示すように、目標とする抵抗値に必要に応じてフォトリソ工法により抵抗層１４をパターニングする。さらに、[illegible]個の抵抗器（１個の独立した抵抗層[illegible]に相当する領域の外周部以外に[illegible]上面のみ形成されるようにする。[illegible]１および抵抗層１４の上面に形成された[illegible]後工程に設ける分割用の縦溝２９に[illegible]９にかからないようにする。

【０１０８】次に、上面電極層１５および抵抗層１４をスパッタした部分の後に、それぞれフォトリソ工程によりパターニングするようにしたことにより、[illegible]および抵抗層１４を薄く形成できるため、[illegible]２８および横溝２９で基板[illegible]に加えてフォトリソ工程により[illegible]パターン[illegible]ため、抵抗層１４[illegible]くすることができ、これにより、高抵抗[illegible]抵抗値変化率を低くできるという効果[illegible]

【０１０９】次に、図[illegible]（ｂ）に示すように、１個の抵抗器（１個の独立した抵抗層１４を有する部分）[illegible]上面電極層１５間の抵抗値を測定[illegible]、レーザートリミングにより[illegible]

【０[illegible]）に示すように、

少なくとも抵抗層１４が露出するように、上面電極層１５の一部の上面に第１のレジスト層２５ａをスクリーン印刷により設ける。この後第１のレジスト層２５ａが安定するように１５０℃、１０分の温度で硬化する。

【０１１１】次に、図１３（ａ）（ｂ）に示すように、露出した抵抗層１４、上面電極層１５の一部、第１のレジスト層２５ａの上面にスパッタによりアルミナなどの酸化物からなる第１の保護層２２を設ける。

【０１１２】次に、図１３（ｃ）（ｄ）に示すように、第１のレジスト層２５ａをリフトオフし、第１の保護層２２をパターンニングする。

【０１１３】このように、下地層１３および保護膜２１のうち少なくとも第１の保護層２２をスパッタにより形成することによって、下地層１３および保護膜２１を緻密に形成できるため、抵抗層１４へ湿気が入り込みにくくなり、これにより、抵抗層が安定するという効果が得られる。

【０１１４】次に、図１３（ｅ）（ｆ）に示すように、第１の保護層２２の上面に樹脂からなる第２の保護層２３をスクリーン印刷により設ける。この後第２の保護層２３が安定するように１８０℃、３０分の温度で硬化する。このとき、第１の保護層２２および第２の保護層２３からなる保護膜２１が、少なくとも全ての抵抗層１４を覆うようにする。

【０１１５】このように、第２の保護層２３をスクリーン印刷により設けることによって、第２の保護層２３を安価に形成できる。

【０１１６】次に、図１４（ａ）（ｂ）に示すように、少なくとも保護膜２１を覆うように第２のレジスト層３１を設ける。

【０１１７】次に、図１４（ｃ）（ｄ）に示すように、紫外線硬化特性を有する接着剤が片面に設けられたシート固定材２７を、基板１１下面の全面に、接着剤が基板１１に接触するようにして貼り付けた後、分割用の縦溝２８を設ける。このとき、抵抗層１４、上面電極層１５、後述する端面電極層１６が縦溝２８に跨がるようにする。

【０１１８】次に、図１４（ｅ）（ｆ）に示すように、基板１１上面に露出している第２のレジスト層３１、上面電極層１５、縦溝２８を覆うように、スパッタにより端面電極層１６を設ける。このとき、縦溝２８内に端面電極層１６が入り込む。

【０１１９】このように分割用の縦溝２８に、端面電極層１６をスパッタにより形成したことによって、非常に薄く端面電極層１６を形成できるため、分割溝２８内に確実に端面電極層１６が入り込み、これにより、安定して端面電極層１６を設けることができるという効果が得られる。

【０１２０】次に、図１５（ａ）（ｂ）に示すように、第２のレジスト層３１をリフトオフし、全ての保護膜２１を[illegible]

【０１２１】[illegible]）（ｄ）に示すように、分割[illegible]のとき、抵抗層１４、上面[illegible]横溝２９に跨がらないようにする。

【０１２２】[illegible]溝２８、横溝２９は、ダイシング[illegible]ーを照射することによって設ける。なお、[illegible]ーザーを用いれば、レーザーの照射された部[illegible]かつ高速に分割用の縦溝２８と横溝２９を[illegible]ため、生産性が向上する。

【０１２３】また、[illegible]縦溝２８と横溝２９は、基板１１とシート[illegible]部に形成される。もちろん、[illegible]２９を基板１１に途中まで形成[illegible]によって基板１１を[illegible]してもよい。

【０１２４】[illegible]ように分割用の縦溝２８、横溝２９に[illegible]面電極層１６を設ける代わり[illegible]における抵抗器のように、[illegible]脂とからなる端面[illegible]を充填し[illegible]によって端面電極層１６を設け[illegible]溝２８と横溝２９に囲まれた[illegible]域内に[illegible]電極層１５を形成できるため、[illegible]した後に端面電極層１６を[illegible]端面電極層１６が基板１１から[illegible]６を含めた抵抗器を[illegible]６が貫通孔２６[illegible]を埋めるように形成すれば、[illegible]できるため、プリント[illegible]ができる。

【０１２５】[illegible]２６を設け、この部分に端面電極層[illegible]基板１１の端面には、切り欠き部[illegible]３０とが形成されることになる。

【０１２６】次に、[illegible]に示すように、１個[illegible]を有する部分）[illegible]含むように凹部３０を[illegible]って、１個の抵抗器[illegible]１[illegible]る部分）に相当する[illegible]る。

【０１２７】[illegible]に示すように、紫[illegible]２７を基板１１から分離させ[illegible]２８と凹部３０が形成されていない横溝２９[illegible]数の抵抗器に分割する。

【０１２８】[illegible]を設けた横溝２９の位置を規[illegible]に含まれる独立した[illegible]

【０１２９】[illegible]にシート固定材２７を[illegible]横溝２９とを基板１１[illegible]１から[illegible]ート固定材２７を

分離させて基板１１を分割するようにしたことによって、分割用の縦溝２８と横溝２９のうち一方を設けたときに位置ずれを起こしてもう一方の分割用の溝を所定の位置に設けることができなかったり、基板１１を分割した時に、個片状の各抵抗器がばらばらに散らばって、この後の工程が煩雑になることを防止できるという効果が得られる。また、シート固定材２７として紫外線硬化特性を有する接着剤を含むものを用いたため、紫外線を照射することによって高速でシート固定材２７の接着力を無くすことができ、これにより、生産性が向上することに加え、シート固定材２７の接着力を根本的に無くすことができるため、基板１１から確実にシート固定材２７を分離できる。さらに、基板１１からシート固定材２７を分離させる工程は紫外線を照射することにより行うため、紫外線を照射することによって容易にシート固定材２７の接着力を無くすことができ、これにより、容易に基板１１からシート固定材２７を分離できる。

【０１３０】最後に、図１６（ｃ）（ｄ）に示すように、端面電極層１６の表面および露出している上面電極層１５の上面に、ニッケルめっき層１８と低融点金属めっき層１９からなるめっき層１７を設ける。

【０１３１】このとき、保護膜２１の上面より各外部電極層２０の上面が上方になるようにする。

【０１３２】図１７は、本発明の実施の形態２における抵抗器をプリント基板３２に、基板１１の上面側をプリント基板３２に向けて実装したものを示す断面図である。

【０１３３】通常は基板の下面側をプリント基板側に向けて外部電極をプリント基板と接触させて実装するが、図１７から明らかなように、基板１１の上面側をプリント基板側に向けても外部電極２０の上面が実装用のはんだ３３を介してプリント基板３２に接触するため、基板の上下面のどちらをプリント基板側に向けても実装可能になる。なお、このような効果は、１個の独立した抵抗層を有する抵抗器や、複数の独立した抵抗層が１つのユニットになっている多連チップ抵抗器のいずれにもいえる。

【０１３４】上記した本発明の実施の形態２における抵抗器は、アルミナより柔らかい樹脂系の材料からなる基板１１を用いたため、基板切断用の刃の摩耗を抑えることができ、これにより、基板の切断コストを抑えることができるという効果が得られる。

【０１３５】また、上面電極層１５、抵抗層１４、端面電極層１６、保護膜２１などの形成後に基板１１を分割するため、基板１１を寸法ランクに分類する必要が無くなり、これにより、工程の煩雑さが解消するという効果も得られる。

【０１３６】さらに、上面電極層１５、抵抗層１４、端面電極層１６、保護膜２１などの形成後に基板１１を分割するため、端面電極層１６などを形成するために基板１１を[illegible]要[illegible]く、これにより、一回[illegible]片状の[illegible]器を得ることができ、[illegible]という効果も得られる。

【０１[illegible]】なお[illegible]実施の形態２における抵[illegible]が１つのユニットになっている多連チ[illegible]説明したが、独立した[illegible]チップ抵抗器についても同様の効果[illegible]ない。

【[illegible]】

【[illegible]抵抗器は、基板と、[illegible]抵抗層と、前記抵抗層の上面[illegible]電極層とを有し、[illegible]ことを特徴とするもの[illegible]より柔らかい樹脂系の材料から[illegible]基板切断用の刃の摩耗を[illegible]基板の切断コストを[illegible]

【[illegible]】

【[illegible]における抵抗器の斜[illegible]

（[illegible]）

【図[illegible]方法を示す図

【図[illegible]方法を示す図

【図[illegible]方法を示す図

【図[illegible]方法を示す図

【図６】（ａ）[illegible]方法を示す図

【図[illegible]】（ａ）[illegible]方法を示す図

【図[illegible]】（[illegible]方法を示す図

【図[illegible]】[illegible]における抵抗器の斜[illegible]

（[illegible]）

【図[illegible]】[illegible]製造方法を示す図

【図[illegible]】[illegible]製造方法を示す図

【図[illegible]】[illegible]方法を示す図

【図[illegible]】[illegible]製造方法を示す図

【図[illegible]】[illegible]製造方法を示す図

【図[illegible]】[illegible]製造方法を示す図

【図[illegible]】（ａ[illegible]）[illegible]方法を示す図

【図[illegible]】[illegible]の上面側をプ[illegible]断面図

【[illegible]８】[illegible]

（[illegible]同[illegible]図

【[illegible]９】[illegible]方法を示す図

【[illegible]０】[illegible]方法を示す図

【[illegible]の[illegible]

１[illegible]　基[illegible]

１[illegible]　切[illegible]

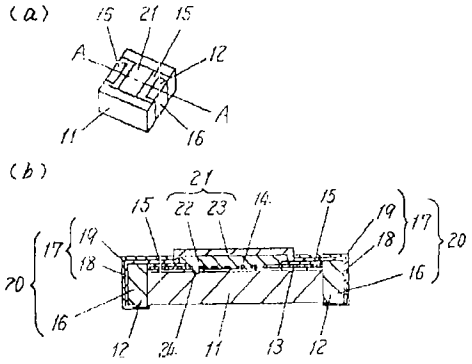
１[illegible]　下[illegible]

１[illegible]

１５　上面電極層
１６　端面電極層
１７　めっき層
２０　外部電極層
２１　保護膜
２２　第１の保護層
２３　第２の保護層
２６　[illegible]
２７　[illegible]
２８　[illegible]
２９　横溝
３１　凹部

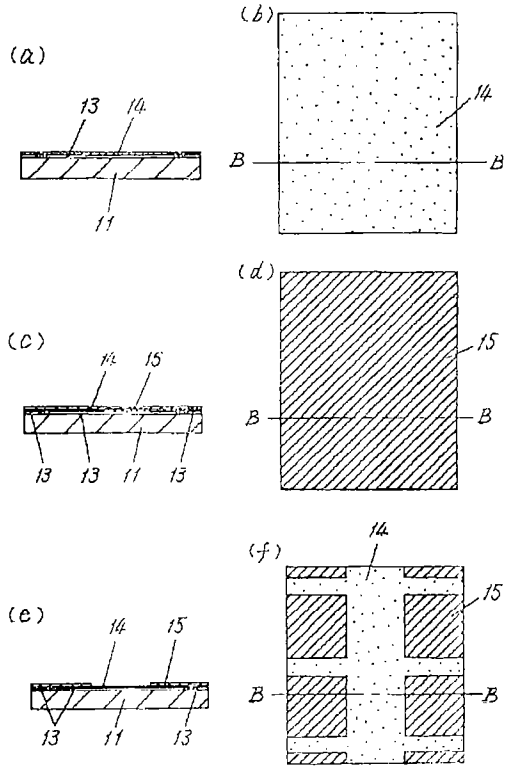
【図１】

11 基　板
12 切り欠き部
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
17 めっき層
20 外部電極層
21 保護膜
22 第1の保護層
23 第2の保護層



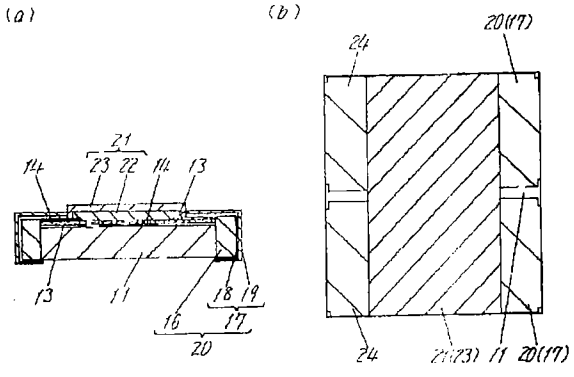
【図3】

11 基 板
13 下地層
14 抵抗層
15 上面電極層



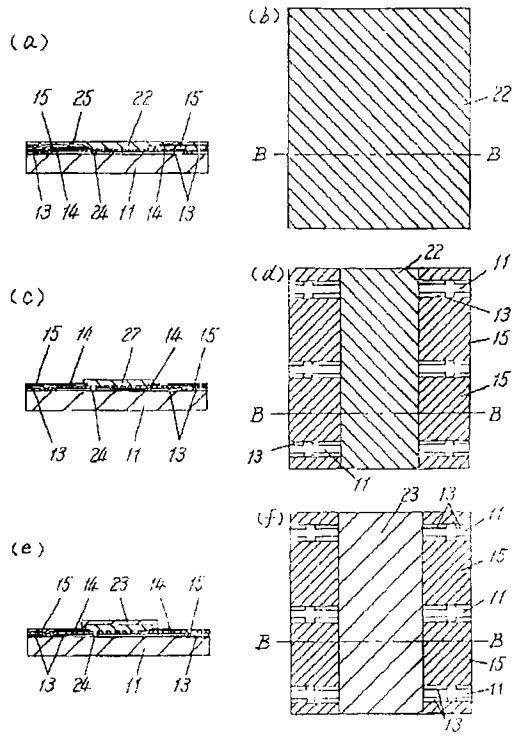
【図8】

11 基 板
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
17 めっき層
20 外部電極層
21 保護膜
22 第1の保護層
23 第2の保護層

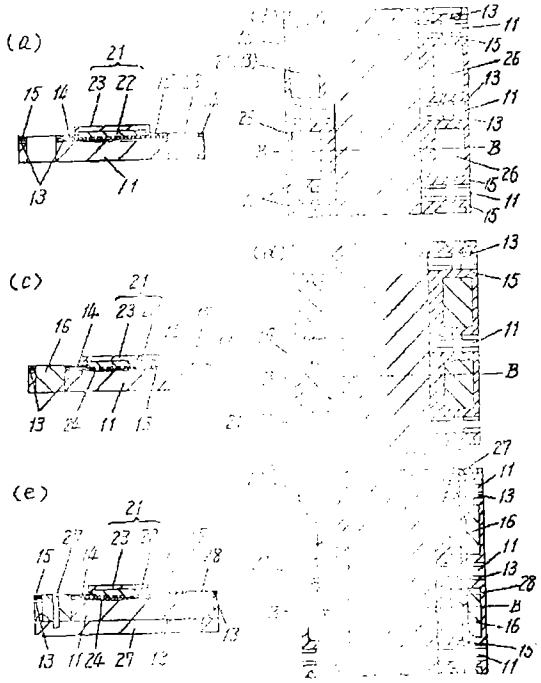


【図5】

11 基　板　15 上面電極層
13 下地層　22 第1の保護層
14 抵抗層　23 第2の保護層

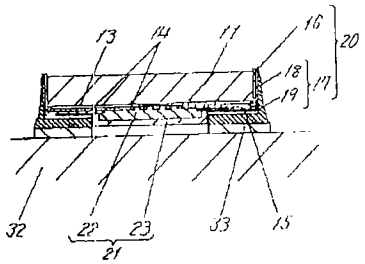


【図6】



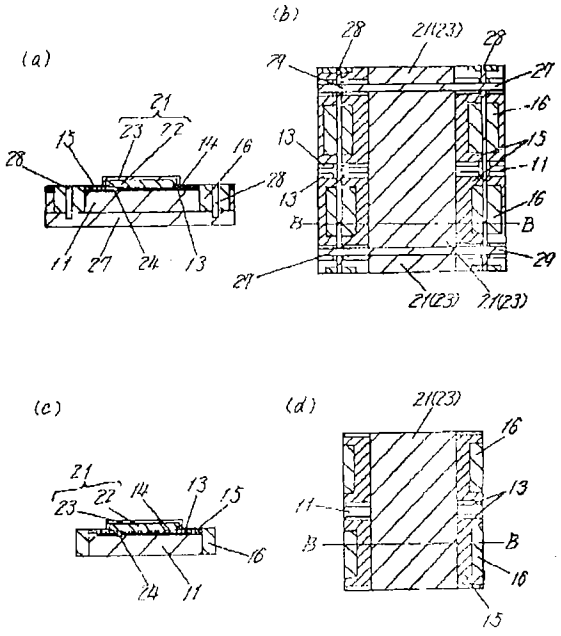
【図17】

11 基　板
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
17 めっき層
20 外部電極層
21 保護膜
22 第1の保護層
23 第2の保護層



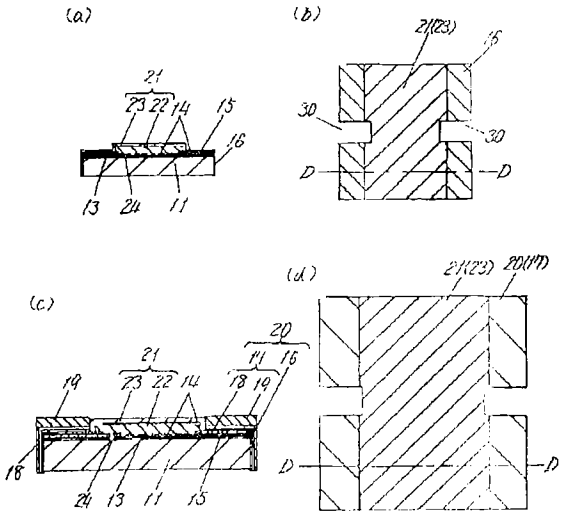
【図7】

11 基　板　　22 第1の保護層
13 下地層　　23 第2の保護層
14 抵抗層　　27 シート固定材
15 上面電極層　28 縦　溝
21 保護膜　　29 横　溝



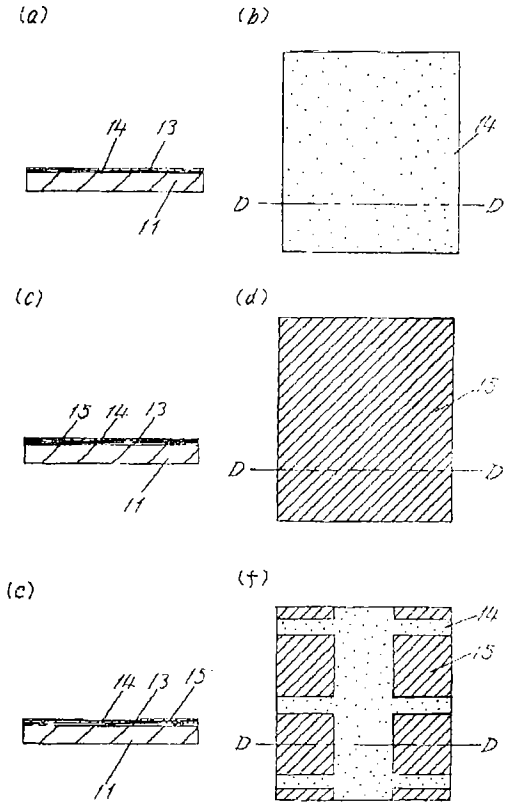
【図16】

11 基　板　　17 ぬき層
13 下地層　　20 外部電極層
14 抵抗層　　21 保護膜
15 上面電極層　22 第1の保護層
16 端面電極層　23 第2の保護層



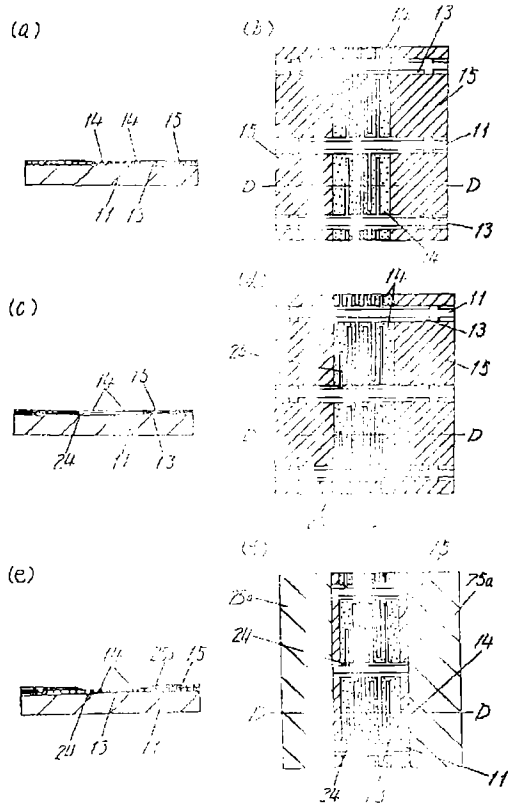
【図11】

11 基板 14 抵抗層
13 下地層 15 上面電極層



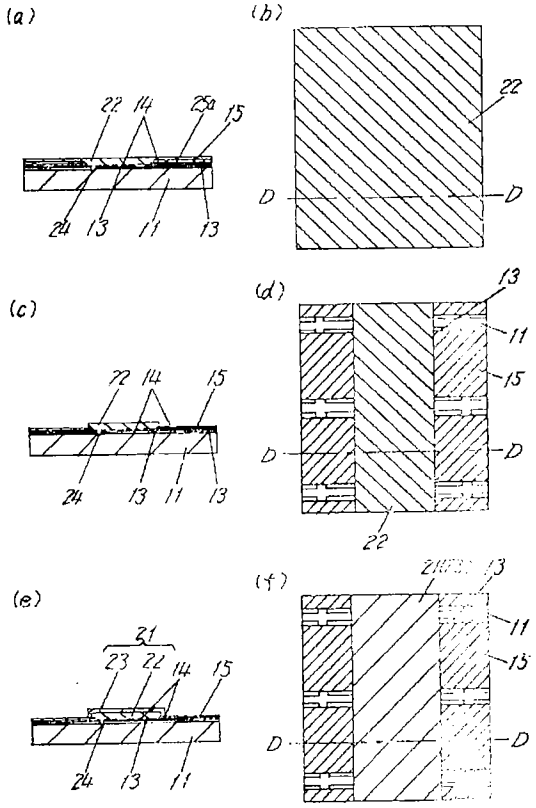
【図12】

11 基板 14 抵抗層
13 下地層 15 上面電極層



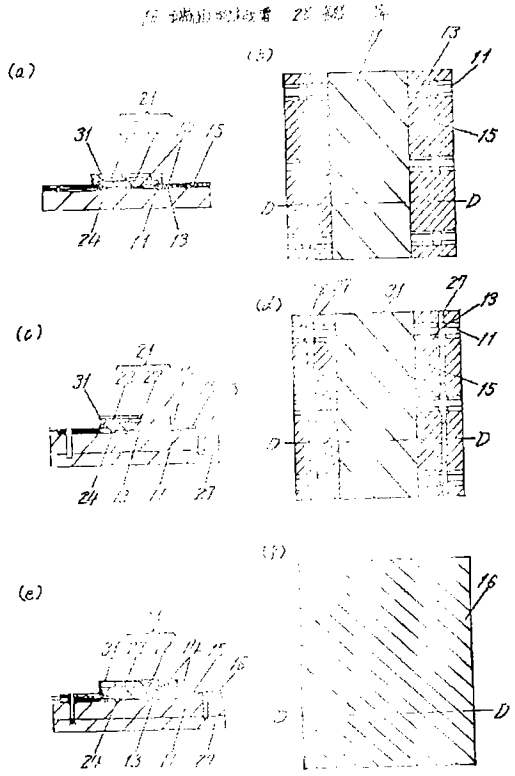
【図13】

11 基板　21 保護膜
13 下地層　22 第1の保護層
14 抵抗層　23 第2の保護層
15 上面電極層

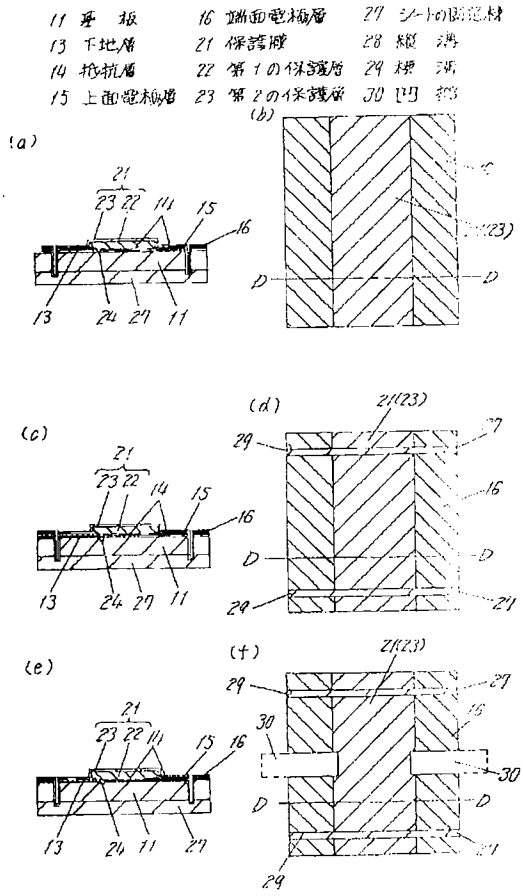


【図14】

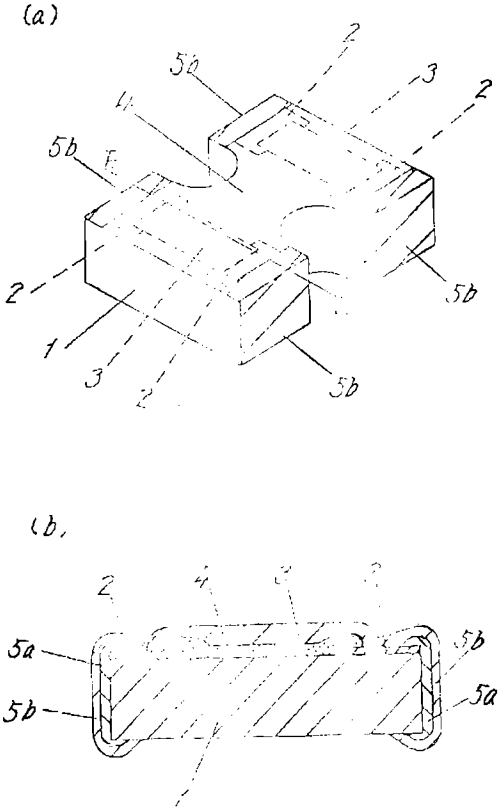
11 基板　21 保護膜
13 下地層　22 第1の保護層
14 抵抗層　23 第2の保護層
15 上面電極層　27 ショート防止材
16 端面電極層　31 絶縁体



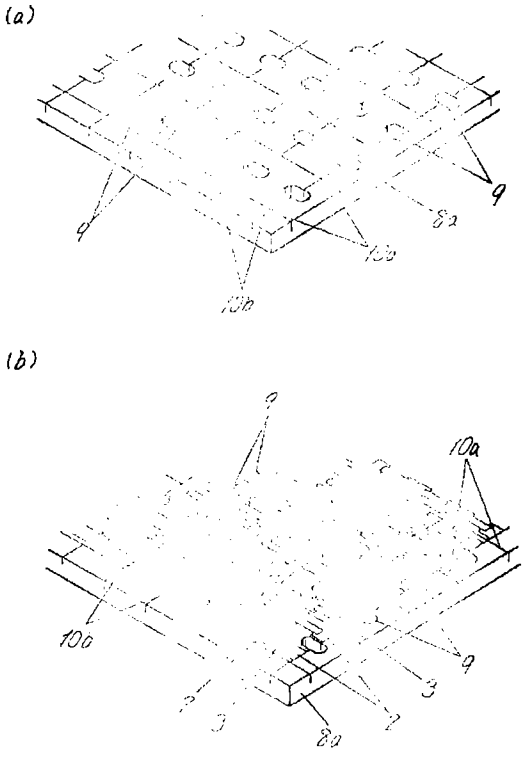
【図15】


11 基板
13 下地層
14 抵抗層
15 上面電極層
16 端面電極層
21 保護膜
22 第1の保護層
23 第2の保護層
27 シートの接着材
28 溝
29 溝
30 凹部
(a)
(b)
(c)
(d)
(e)
(f)

【図18】

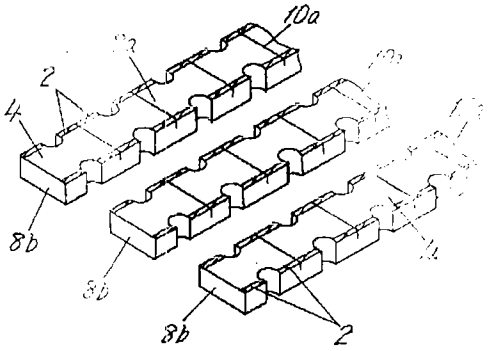

(a)
(b)

【図19】

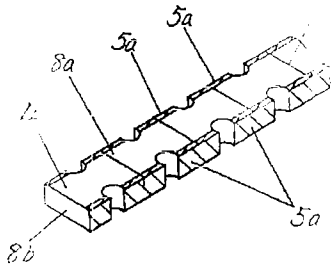

(a)
(b)

【図２０】

(a)



(b)



フロントページの続き

Ｆターム(参考)　5E032 BA11 BB13 CA02 CC03 CC07
CC14 CC16 CC18 TA11 TB02
5E033 AA01 BB02 BC08 BE02 BE04
BF05 BG02 BH02 BH03